

*W. E. Stock*  
*1800*

A BRIEF  
HISTORY  
OF  
EPIDEMIC AND PESTILENTIAL DISEASES;  
WITH THE  
PRINCIPAL PHENOMENA OF THE PHYSICAL  
WORLD, WHICH PRECEDE AND AC-  
COMPANY THEM,  
AND  
OBSERVATIONS DEDUCED FROM THE  
FACTS STATED.  
IN TWO VOLUMES.

*Vol 7 PC*

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By NOAH WEBSTER,

Author of Dissertations on the English Language and several other  
Works—Member of the Connecticut Academy of Arts and Sciences  
—of the Society for the Promotion of Agriculture, Arts and Man-  
ufactures, in the State of New-York—of the American Academy  
of Arts and Sciences, and corresponding Member of the Histori-  
cal Society in Massachusetts.

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V O L. II.

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## ERRORS.

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### VOL. I.

- PAGE 337, line 12, erase the following words—" *but its progress was limited to one street near the water.*" See the fact in page 345.  
340, The last paragraph, save one, is misplaced—it belongs to the postscript about the middle of page 347.  
310, line 20, for *Tome*, read *Torre*.

### VOL. II.

- PAGE 3, In the account of deaths in Dresden in 1631, for 144, read 844. This correction is material, as the true number marks the increased mortality preceding the plague in the two following years; that is, the *progression* in the pestilential condition of the elements.  
52, line 9 from bottom, read *Horslius*.  
178, line 11, for *elysian* read *Etesian*.  
182, line 14, for *By* read *But*.  
191, line at bottom, read *repealed*.  
216, line 3, read *axillary*.  
292, line 4, from bottom for *observed* read *observed*.

A few literal errors are not noticed; and possibly some material ones may have escaped observation.

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## SECTION IX.

*Bills of mortality for the two last centuries, with the principal phenomena of the elements.*

OUR accounts of diseases and the phenomena of the world, which appear to be connected with them, are altogether imperfect. But in the two last centuries, we have a tolerable history of diseases, and occasionally an account of the seasons, and remarkable occurrences. In the following tables, the reader will find the bills of mortality for London, Augsberg, Dresden, Boston, one Church in Philadelphia, with a few bills of Paris and Dublin; to which are prefixed such of the remarkable phenomena of the elements, as I have been able to collect. As winter makes a part of two years, the word *severe* is set against the year which preceded the winter. Thus against the year 1607, the word *severe* refers to the winter of 1607-8. The blanks denote, either that nothing singular occurred in those years, or that I have no account of the occurrences. Further enquiries might probably enable me to fill many of those blanks.

Bills of mortality do not exhibit a complete view of epidemics; as some of the more remarkable, especially *influenza*, destroy but few lives, and the bills of the years when that disease alone prevailed, are remarkably low. It is often the immediate precursor of pestilential diseases in autumn; in which cases, the bills of the year are very high.



A. D.	SEASONS.		Other phenomena.		DISEASES.	Burials in London.		
	Summer.	Winter.	Comets.	Volcanoes.		By com- mon dif.	By the plague.	Total.
1600					general pestilence			1775
1601	very dry	severe		S. America	plague in Portugal and other places			1570
1602	cool & dry	cold Eng.		Etna	influenza, plague	5773	36269	42042
1603			comet	S. America	plague London, and general famine	4323	896	5219
1604						5948	444	6392
1605						5796	2124	7920
1606					plague in Cork	5670	2352	8022
1607	hot	severe	comet	Etna	plague in Cork, dysentery	6758	2262	9020
1608	hot		comet	Etna	plague in Denmark	7554	4240	11794
1609	very dry	severe			influenza, sore throat in Spain	7486	1803	9289
1610					plague in Constantinople	6716	627	7343
1611	very dry		comet		malignant fevers	7778	64	7842
1612					plague in Constantinople, fatal fevers in France	7503	16	7519
1613		severe		Etna	fatal small-pox epidemic, measles in Persia	7367	22	7389
1614						7850	37	7887
1615	cool				quartan agues general	8063	9	8072
1616	hot and dry					8280	6	8286
1617	hot and dry				pestilence among Indians in America, angina Naples	9596	18	9614
1618			4 comets		pestilential fevers in France	8000	9	8009
1619				Iceland	fevers	9691	21	9712
1620		cold	comet		small-pox	8112	11	8123
1621			comet			9420	16	9436
1622	dry Amer.							1959

A. D.	Summer.	Winter.	Comets' Volcanoes	DISEASES.	London.	Augt Dref.
1623				malignant fevers, precursors of the plague	11095	11112
1624				the same, increased mortality, previous to the plague	12199	1875
1625			comet	plague in London, Denmark, Italy and Holland, &c.	11	12210
1626	hot			plague in Lyons, Wirtemberg, &c.	35417	54265
1627				plague in France, &c.	134	7534
1628				plague in France, Augsburg, &c.	713	7717
1629				plague in Amsterdam, &c.	3	7743
1630				plague in Vienna, Cambridge, &c.	0	8771
1631				erysipelous fevers, diseases of the throat	1317	10545
1632	hot	severe En.		eruptive fevers, plague in Dresden	274	8562
1633	hot	severe En.	comet	plague at Ratibon, fevers in London precursors of the	8	9535
1634	hot	severe. Am.		plague, Augsburg, Leyden, Mentz, &c.	10899	8592
1635		mild		plague, London, Nimeguen, (plague)	1	10900
1636				sickly year in America, small-pox and fevers	10400	23359
1637	hot Eng.	severe			12059	10651
1638	hot & dry				3082	11763
1639	dry Ame.				13261	13624
1640					363	638
1641		severe En.			9548	9862
1642		severe. Am.			314	12771
1643	hot & dry				1450	586
1644				malignant fevers	11321	12771
1645	hot Eng.			sickness among Indians, America	11767	13142
1646				plague, London	11999	587
1647	hot Ame.		comet	plague Lond. influenza Amer. fevers (and Shropshire	1274	13273
1648				malign. fevers in Italy, France & Spain, plague in Ireland	996	13212
					9441	638
					1492	11933
					9608	659
					1871	11479
					2365	758
					10415	12780
					10462	1488
					3597	14059
					611	1388
					9283	471
						9894
						2208
						666

A. D.	Summer.	Winter.	Comets	Volcanoes	DISEASES.	London.	Augt. Dref.
1649				Etna	plague in Spain, small-pox in Bolton	10499	10566
1650	hot				plague in Cork, influenza Europe	8749	8764
1651	dry Eng.		comet		quinty in Italy	10444	10467
1652	dry Eng.				fevers	12588	12604
1653	dry Eng.				sickly New-England	10081	10087
1654	dry Eng.	severe		Vesuvius	plague Denmark, Chester, Turkey, &c.	13211	13247
1655	hot				influenza America, general plague Europe	11368	11377
1656	hot	severe			plague Italy, &c.	13915	13931
1657	hot				plague Genoa	12430	12434
1658	wet Ame.				influenza Europe, mortality America	14979	14993
1659				Ves & Ice.	cynanche trachealis America	14710	14756
1660					measles England	15104	15118
1661	dry Ame.		comet		measles, tertians	19791	19811
1662	dry Ame.	mild			sickly in America	16542	16554
1663	wet	severe	comet	Etna	fevers Venice, among cattle England, plague Holland	15347	15356
1664			comet	Etna	purple fever Prussia, corn mildewed	18291	18297
1665			comets	Etna	plague London, and over Europe	68596	68596
1666	hot & dry				dysentery over Europe, small-pox Bolton	28710	28710
1667			comet	Etna	fevers Persia, &c.	1998	1998
1668		severe		Etna	fever New-York, Europe small-pox	17294	17294
1669	hot	severe		Etn. great	dysentery, fevers, measles, cat plague Westphalia	19436	19436
1670				Etna	measles London, small-pox	20198	20198
1671				Etna	measles and small-pox	15789	15789
1672	cold Eng.	cold	comet	Etna	catarrha numerous	18230	18230
1673				Etna	fevers, measles London, and small-pox	17504	17504
1674				Etna		21201	21201

A.D.	Summer.	Winter.	Comets.	Volcanos.	DISEASES.	London.	Aug.	Dref.
1675	wet & cool E.	severe	meteor	Etna	influenza Europe	1724	913	947
1676	cold Eng.		meteor	Etna	measles and small-pox Genoa, England	1873	913	1284
1677			comet	Etna	small-pox Charleston, Mass. dysentery Denmark	1906	934	887
1678	dry and hot		comet	Etna	dreadful plague Morocco, small-pox Boston and S. America	2067	943	1020
1679		severe	comet	Etna	catarrhs, plague, Vienna	2170	945	975
1680	hot and dry	severe	comet	Etna	plague Dresden, coughs epidemic, dysentery	2103	976	644
1681	very dry					2391	860	753
1682			comet	Et. & Vesu.	murrain among cattle, spotted fever Dublin, plague at Halle	2069	734	1023
1683		very severe.	comet		fevers	2058	808	1200
1684	hot & dry E.	cold			malignant dysentery over Europe	2320	858	1154
1685	hot & dry E.					2322	848	937
1686	dry Italy		comet	Etna		2269	981	1199
1687	rainy Eu.					2260	855	927
1688		severe		Vesuvius	influenza Europe	2292	860	1012
1689	autum. rainy		comet	Et. & Vesu.	spotted fevers Germany, small-pox Boston	2350	806	1163
1690	rainy	severe			corn mildewed	2146	1071	1200
1691	hot and dry				spotted fevers Europe, corn blasted, diseases among cattle	2269	185	1166
1692	hot			Etna	malignant fevers	2087	935	999
1693	hot	cold Eu.		Etna & Icel.	influenza Europe	2059	1084	1071
1694	hot			Ves. & Band.	malignant fevers	2410	1106	1416
1695	rainy Euro.				apoplexies, measles, chin cough, sickly America	1904	1048	1327
1696	cold, wet E.				dysentery among children, spotted fevers	1868	927	1055
1697		severe			spotted fever Europe, catarrh America began	2090	777	1070
1698		severe	comet	S. America	influenza America, spotted fever Europe	2018	879	919
1699	hot America		comet		influenza Europe, plague Philadelphia and Charleston and Levant	2079	940	1139
1700		mild			sore throat and catarrhs Europe, measles	1944	286	1192



A.D.	Summer.	Winter.	Comets	Volcanoes.	DISEASES.	London	Augt	Decr.	Febr.
1701	hot & dry			Vesuvius	plague in the east	24071	906	902	146
1702	hot & dry		comet	Etna	plague Poland, yellow fever N. York, small-pox Bolton	19481	900	946	441
1703					plague Poland	20720	1245	1078	159
1704	dry Euro.				plague in Poland and Hungary, spotted fevers	22684	1313	964	220
1705	hot, dry E		comet		plague in Russia	22097	748	1346	282
1706	very hot		comet		coughs, dysentery among children	19847	842	1098	261
1707		very feve.	comet		measles England, plague at Wafaw	21600	803	1523	263
1708			meteor		catarrh began in Europe, plague in Thorn	21291	908	1119	291
1709					catarrh, plague in Dantzick, apoplexies	21800	803	1340	377
1710		cold Eur.			plague in Lithuania, catarrhus fevers Eng. and Holland	24620	811	1214	295
1711	wet Eng.		comet	Vesuvius	plague in Copenhagen, and among cattle terrible	19833	855	1222	363
1712	dry & hot	mild			catarrh Europe, plague in the east	21198	894	1140	316
1713	dry				measles America, plague in Austria	21057	860	1383	480
1714	very dry	severe	comet		small-pox and measles England	26569	948	1250	413
1715	dry	severe	comet		catarrhus fevers Europe	22232	1024	1353	336
1716	hot, wet	cold Am.	comet		malignant fevers, plague Turkey	24436	905	1274	355
1717	dry Euro.		meteor		plague Levant, pestilential fevers, malign. pleurisy Amer.	23446	988	1908	451
1718					plague in Levant and Marfeilles, malign. pleurisy Amer.	26523	7	1412	380
1719					small-pox Bolton	28347	997		304
1720	cold, wet		comet		measles England	25454	934	1733	329
1721					small-pox in England, plague Barbadoes	26142		1850	1102
1722	wet Eng.	cold	comet		whooping cough England	25750		1519	273
1723					plague in Egypt	29197		1654	413
1724	wet Eng.					25952	Dub.	1761	407
1725	wet Eng.					25523	in.	1642	324
1726						29647	2763		343

A. D.	Summer.	Winter.	Comets	Volcanoes.	DISEASES.	London	Dub.	Bost.	Phil.
1727	dry hot A.		comet.	Vesuv. & Ice.	lickly year	28418	2946	479	130
1728	hot Ame.	severe Eu.		Iceland	plague in Egypt and Carolina (and malignant pleurisy	27810	498	498	86
1729			comet	Iceland	universal catarrh Europe, plague in Aleppo, measles America	29722	3206	570	88
1730		very cold E.		Ice. & Vesuv.	small-pox in Boston, pestilential fevers S. America	26761	2184	909	81
1731					anginas in Holland, small-pox New-York	25262		408	166
1732		severe Ame.	comet		plague in Syria, Charleston and New-York, catarrh began	23358	2534	499	97
1733	dry Eng.				catarrh universal, plague in Aleppo	29233	2608	458	103
1734	wet				'carlet fever Edinburgh, small-pox and fevers (vers, hydro-	26062	2466	528	116
1735	wet				forethroat Am. measles, swelling in jaws, coughs, catarrhs fe-	23538	2196	455	96
1736	wet				forethroat Am. & Fr. measles Eng. dreadful plague in Egypt	27581	2101	617	144
1737		very sev. A.	comet	Vesuvius	forethroat, universal catarrh, diseases of horses	27823		607	112
1738					pestilence in Barbadoes, Oczakow and New-Spain, measles	25825	2506	576	107
1739	wet Eng.	very sev. Eu.	comet		pestilence Charleston, measles America	25432	2201	554	97
1740		very sev. A.			measles America, whooping cough and spotted fever Eng.	30811		704	98
1741					pestilence Philadelphia and Virginia, spotted fevers England	32169	2790	555	162
1742	hot	severe Syria	comet	(at Catapaxi	forethroat America and England, plague Aleppo, &c.	27483	2320	517	123
1743			comet	(in S. Amer.	pestilence Syria, Messina, N. York, catarrh Italy and France	25200	2193	620	116
1744					epidemic catarrh Europe	20606	1705	499	114
1745				S. America	infectious fevers and dysen. prevalent Am. plague Egypt, &c.	21296		780	125
1746	hot & dry	severe		Etna	infectious fever Albany and among the Indians, dysen. Switz.	28157	1957	578	186
1747	dry				influen. universal, pestilence Phil. anginas Eng. sickly Boston	25494		777	192
1748	very dry				pestilence Charleston, anginas Eu. long fever Am. and measles	23869	1530	749	175
1749	very hot				dysenteries Europe and America, anginas Europe	25516	1819	677	128
1750	wet Eng.	very severe	comet	Vesuvius	dysenteries America and Europe, plague Barbary coast	23727	2088	604	125
1751	ve. hot A.	severe Ame.			plague Turkey, dysenteries fatal America and anginas	21028		624	144
1752					small-pox in Boston, anginas in Ireland and America	20485	1844	1009	129

A. D.	Summer.	Winter.	Comets	Volcanocs.	DISEASES.	London	Dub.	Boft.	Phil.
1753	severe			Vefuvius	malignant fever in Rouen from vapor, anginas America	19276	1825	481	105
1754	mild Amer.			Etna	gangrenous fore throat England, Ireland and America	22696	1897	434	94
1755	severe Euro.				catarrhs Europe, anginas Europe and Am. plague Constanti.	21917	2002	484	99
1756	severe Syria		comet	Iceland	influenza America began	20872	1550	526	213
1757	hot		meteor		influenza America, measles	21313	1825	434	97
1758			comets	Vefu. great	influenza Eu. plague began in Egypt and Smyr. measles Am.	17576	1558	524	129
1759	severe			Vefuvius	measles and dysentery America, plague Levant	19604	1752	629	271
1760				Azores	plague extends in Levant, terrible fever in America	19830	1993	576	174
1761	ve. dry A		comet		influenza America, plague extends Levant, fever America	21063	2292	456	144
1762	ve. dry A	severe	comet		influenza Europe, pestilence Phila. crisis of plague Levant	26326	2490	531	200
1763	hot Euro.		meteor	Etna	pestil. at Nantucket and in Bengal, dizeases among animals	26143	2605	407	180
1764	hot Euro.			Etna	yellow fever Cadiz, pestilence in Naples, small-pox Boston	23202	2307	548	139
1765	severe Euro.				dysenteries	23230	2275	560	186
1766	(hot and dry Eur.	very severe	comet	(Etna, Vefu. (and Heckla	dysentery America	23911	19664	445	133
1767	cold		comet	Vefuv. great	influenza Europe	22612	19875	468	121
1768	hot				dizeases among horses America	23639	20868	417	123
1769	hot		comet		fore throat Boston and other places, measles Am. dizeases a-	21847	18427	645	188
1770	wet Eng.		comet	Ter. & Vefu.	fore throat America and West-Indies, plague Constantinople	22434	18719	483	127
1771	wet A. E.	cold Europe	comet		plague in Russia, dizeases among cattle, cataarrhs Am. pesti-	21770	18941	482	139
1772	hot Ame.	A. gr. snow	meteor	Vefuvius	cataarrh America and measles	26053	20374	517	157
1773					measles, affections of the throat, dysentery Am. plague Baf-	21656	18518	595	179
1774		severe Euro.		Pac. in Gua.	scarlet fever Edin. in some places in Am. (fora & Bagdad)	20884		596	161
1775		severe Euro.	meteor	Vefuvius	cataarrh in Europe, dysentery in America and anginas	20541	18400		156
1776	hot				dysentery America and anginas	19048			180
1777		severe Euro.		Ferro	dysentery in America and measles	23334			222

A. D.	Summer.		Winter.	Comets	Volcanoes.	DISEASES.	London	Paris.	Phil.
	hot	mild	very severe						
1778	hot	Eng.	very severe	halo	Vesuv. great	typhus fevers, plague Constantinople	20399	17112	183
1779	hot	Eng.	very severe	halo	Etna	health	20420	142	142
1780	hot	Eng.	very severe	halo	Etna	bilious fever Philadelphia, general health, plague in Smyrna	20517	Salem	155
1781	dry Amc.			(me's)		influenza America	20709	Maff.	179
1782	dry Amc.			many		influenza Europe, scarlatina began in Edinburgh	17918	175	198
1783	hot		very severe	comet	Heckla gre.	measles and scarlatina Amer. famin India, plague in Egypt, &c.	19029	189	232
1784	hot			comet	Vesuvius	plague in the east, angina America, canine madnefs	17828	140	230
1785	dry Euro.	cold			Vesuvius	angina, fevers America	18919	114	166
1786	cool	cold				yellow fever Cadiz, angina America and England	20454	138	156
1787	cool	cold		(comet)	Et. & Vesuv.	plague Barbary coast	19347	110	147
1788	rainy Am.	cool		meteor		measles began N. York and Phila. codfish sickly, influenza Eu.	19697	144	126
1789	(cool spri.	(severe Eur.		halo	Vesuvius	{ famin in Asia, dearth in America, measles America and influ- enza, death of haddock Europe, plague in the east.	22744	129	164
1790	(hot sum.	(mild Amer.				influenza America	18038	203	145
1791	ve. hot A.	cold				plague began in Egypt, bilious pestilence began in New-York	18760	148	183
1792	ve. hot A.	cold				plague in Egypt, scarlet fever began in America	20213	142	125
1793	hot, dry A	mild Amer.		comet		scarlet fever Am. and Eng. pestilence Phil. dysentery Maryland	21749	148	393
1794	hot, dry A	severe Euro.			great, of Ve.	scarlatina, pestilence New-Haven and Baltimore, dysentery	19241	122	172
1795	America					{ scarlatina, pestilence New-York and Norfolk, dysentery New-Haven, influenza England	21179	195	223
1796	hot, rainy autumn					{ scarlatina, pestilence N. York, Boston, Charleston, Newbu- rport, measles America	19288	216	213
1797	ver. dry A	cold Amer.				{ influenza Europe, pestilence Phil. Balti. Prov. Norfolk, and among cats and other animals in Turkey, canine madnefs			
1798	cool Am.	severe Amc.		comet	Andes and	pest. Phil. N. York, Bost. N. Lond. Port. Wilming. in Turkey	17014	147	197
1799	very hot	long and se-		comet	Guadaloupe	pestilence Philadelphia, New-York, Hartford			
1799	ve. dry A	(vere A & E.			Teneriffe				



## SECTION X.

*Remarks on the preceding History and Tables.*

**I**MPERFECT as ancient history is, in regard to the accounts of diseases, and the extraordinary phenomena of nature, we find that between the year B. C. 480 and the Christian era, a number of violent plagues occurred, most of which coincided in time with the following phenomena, comets, eruptions of volcanoes, earthquakes, drouth, severe winters, diseases among cattle. Of thirteen comets mentioned in the foregoing history, which are all whose dates I am able to ascertain, *eight* of them coincide with volcanic eruptions of Etna, the only volcano of any note, which the history of that period has recorded; and *eleven* of them coincide in time with pestilence. If we consider the scarcity of our materials for a history of these phenomena, at that period, and make due allowances for the uncertainty of chronology, we shall find reason to be surprised at such a number of these coincidences. In several instances we find extreme drouth and very severe winters to correspond in time with comets and eruptions of Etna, conformable to facts in modern days.

On this subject, history is barren also for many centuries after the Christian era. Yet in every period, even in the dark ages, we find numerous coincidences of the great phenomena above mentioned. All the great plagues that have afflicted mankind, have been accompanied with violent agitations of the elements.\*

\* Modern philosophy objects to the popular sense in which the word, *elements*, is used; since it appears that what has usually been considered as an *element*, is found by modern chymistry to be a compound substance, resolvable into parts, in their nature and properties, distinct. Notwithstanding these discoveries, I cannot consent to discard the popular use of the word *element*. Nature presents to the senses of man, fire, earth, air and water, in a particular and predominant form.

This observation rests particularly on the events that preceded and attended the pestilences of the following periods. A. D. 80—167—252—375—400—445—542—558—590—639—679—682—745—762—802—905—994—1005—1031—1044—1069—1106—1135—1142—1162—1181—1222—1242—1300—1347—1368—1400—1477—1500—1531—1577—1602—1625—1636—1665—1699—1709—1719—1728—1743—1751—1760—1770—1783—1789. Many facts in other periods concur to prove the truth of the remark.

The phenomenon most generally and closely connected with pestilence is an earthquake. From all the facts that I can find in history, I question whether an instance of a considerable plague in any country, can be mentioned, which has not been immediately preceded or accompanied with convulsions of the earth. If any exceptions have occurred, they have escaped my researches. It does not happen that *every place* where pestilence prevails, is shaken; but during the progress of the diseases which I denominate *pestilence*, and which run, in certain periods, over large portions of the globe, some parts of the earth, and especially those which abound most with subterranean fire, are violently agitated.

By adverting to the foregoing history, the reader will find that all those years, in which considerable earthquakes have occurred in America, have been remarkably sickly. These years are 1638, 1647, 1658, 1662 and 3, 1668, 1727, 1755, 1783. See the history and the bills of mortality. Even the slighter shocks, have been attended with considerable sickness, or have introduced a series of epidemics, being cotemporary with the measles, influenza or sore throat; as in 1669, 1720, 1737, 1757, 1761, 1769, 1771, 1791, 1797.

To enumerate the instances in Europe and Asia, would be a useless repetition of the events related in the preceding history, to which the reader is referred.

Another phenomenon, which, next to earthquakes, appears

This is the form in which they appear to be most useful to man, and to be the constituent materials of other substances, as well as the agents in carrying on the great visible operations of the system. I therefore consider the popular distribution as natural and convenient.

to be most closely connected with epidemic diseases, is the eruption of fire from volcanic mountains. In this article, history is deficient, or I have not been fortunate enough to find the works necessary to furnish a complete view of these phenomena. There are whole centuries in which the books I have consulted, mention no eruption of Etna and Vesuvius. The account of eruptions in Iceland, from the year 1000, taken from Pennant's *Arctic Zoology*, vol. 1. 331, is probably complete, or nearly so. Of the volcanoes in the Andes, we have very few accounts; as well as of those in the Moluccas. Of those in the Arctic regions of Asia and America, we know very little.

Notwithstanding these defects, we are able, by the eruptions in Italy, Sicily and Iceland, to arrive to some very important conclusions. The reader must have noticed, in the preceding history, the coincidences in time between volcanic discharges, and winters of unusual severity. These discharges either precede or follow the winter. Thus the eruptions of 1766, 1779 and 1783, were immediately followed by intensely cold winters. The severe winters of 1762-3 and 1779-80, were speedily followed by eruptions. These instances will serve as samples of the ordinary course of these events. Sometimes the eruptions continue or are repeated, for a number of years in succession; but the eruptions when continued are moderate and the seasons variable. When the volcanoes have been, for some years, quiet, and that suspension is followed by a great discharge, it appears to me that severe winters invariably follow or precede the discharge, within a few months. So also when an eruption is continued for a number of years, if at any time the discharge becomes violent, a severe winter attends it; as in 1669. Etna was in a state of eruption from 1664 to 1679; but in 1669, the discharge was immensely augmented, and the winters next preceding and following, were very severe.

There are some years in which eruptions are noted, of which I find no account, respecting the seasons. Perhaps some of these will, on further investigation, be found to be exceptions.

It is to be observed that, in some cases, a severe winter extends to both hemispheres, sometimes to one only, and in a few

cases, to a part of a hemisphere only. Thus in 1607-8—1683-4—1762-3—1766-7—1779-80—1783-4, the severity extended to both hemispheres. In 1640-41—1739-40, and in other instances, the severe winter in Europe preceded, by one year, a similar winter in America. In a few instances, severe frost takes place in one hemisphere, during a series of mild winters in the other; but this is less common. In general, the severity happens, in both hemispheres at once, or in two winters in immediate succession; and as far as evidence has yet appeared, this severity is closely attendant on volcanic discharges, with very few exceptions.

Another phenomenon which usually coincides in time with severe winters, is the approach of comets. I have been struck with surprise at the coincidences of this kind. There are a few instances on record of mild winters, during the appearance of these bodies; but in these cases, the comets have appeared to be small, or to pass the system at an immense distance from the earth. The large comets and those which approach near to the earth, seem to produce almost uniformly great heat, excessive drouth, followed by very cold winters, tremendous storms of wind, rain, snow and hail, unusual tides or swell of the ocean, and usually, volcanic eruptions. How far these phenomena are connected; as cause and effect, future observations may determine. Some of them occur so uniformly in the same year, that I cannot resist the evidence of their connection.

After a volcano has been many years quiet, its discharges are, I believe, always preceded by extreme drouth; and this defect of water is not only observable in the vicinity of the volcano, but often extends over a whole continent, if not over the world. Many instances have been related; it is sufficient here to mention the excessive drouth in 1762 and 1782, preceding eruptions of Etna and Heckla. In these years, almost all springs were exhausted over a great portion of America.

Cold winters sometimes follow wet seasons, but more generally a very hot summer or very dry autumn. Sometimes two or three severe winters occur in succession, as in 1766, 67 and 68—and in America from 1796 to 1799.



The years when comets approach, or volcanoes discharge fire, and when the atmosphere exhibits fiery appearances, as meteors, streams of light, and mock suns, are, beyond comparison, the most tempestuous. Witness the years 1766, 1771 and 72, 1780, 1783, 4 and 5, 1788, 1797. In such years, the risk on vessels at sea, is greatly increased.

As dry seasons usually precede volcanic eruptions, so very wet seasons often follow them. This seems not to be the invariable course of events; but there are remarkable instances of deluging rains after these discharges. Witness the seasons following the universal convulsions of the earth in 1692 and 3, and 1766. Thus, the electricity is re-conducted to the earth.

In every case, I believe this remark will be found true; that the approach of comets, and volcanic eruptions disturb the regular course of the seasons. The heat of summer and the cold of winter are in extremes; more snow is generated in winter, and more hail in summer; tempests are more violent and frequent; meteors more numerous, and rain more unequally distributed over the earth.

A series of epidemic diseases, measles, influenza, affections of the throat, followed by pestilential fevers, appear generally to commence and take their departure, from some of the great agitations of the elements above recited. This at least has been the case in America in the four last periods, beginning with 1756-7, 1769 and 70, 1782 and 3, 1788 and 9. This fact will want no authority but a bare inspection of the preceding history, and tables.

The continuance and the varieties of the diseases seem to depend on similar disturbances in the elements; and as the discharges and motions of the electrical fluid depend on no certain laws that are known, they are irregular, and may contribute to vary the order, and the nature of diseases. In some cases, there has been a continued series of epidemics, for twenty years, in which the common order is not exactly observed; but this is not frequent. A remarkable instance occurred between 1727 and 1744.

Those periods in general have been most distinguished for

sickness over the world, in which the fire of the earth has exhibited the most numerous and violent effects. Witness the period from 1631 to 1637, when the three most noted volcanoes discharged immense quantities of fire and lava; and severe pestilence extended over all Europe and America. A similar remark may be made concerning the period of the last universal pestilence in Europe from 1663 to 1666—also from 1691 to 1695—from 1727 to 30—1759 to 1764—1769 to 1772—1774 to 1777—1783 to 1786—and concerning some shorter periods, all of which produced epidemics in both hemispheres.

Slighter eruptions and earthquakes, which are almost annual, seem to have less effect. The fire of the globe is in perpetual motion or action, and to this great agent, philosophers are agreed, are to be ascribed the changes of seasons, and the generation of rain, hail and snow. Its operations however are not all of them visible, nor even perceptible, until they appear by their effects. It is probable that the *invisible* operations of the electrical fluid produce more effects than those which are seen. Indeed, we may question whether most of the visible phenomena of that principle, are not mere *effects* of that action which influences the vegetable and animal world. It is probable to me that neither seasons, earthquakes, nor volcanic eruptions, are the causes of the principal derangements we behold in animal and vegetable life, but are themselves the *effects* of those motions and invisible operations which affect mankind. Hence catarrh and other epidemics often appear, *before* the visible phenomena of eruptions and earthquakes.

P. S. After this work was prepared for the press, I was favored by Dr. Mitchill, with some extracts from a paper of Mr. Holm, a Swede, on the subject of a volcanic eruption in Iceland, in 1783, by which it appears that the atmosphere is rendered pestilential by discharges of fire and lava from the earth. This effect is supposed to be wrought by a combination of the septic and oxygenous parts, and may confirm and improve Dr. Mitchill's theory of pestilential air.

This eruption I understand to have been a bursting of fire from the earth, in a place distant from Heckla. In the neighborhood of the column of flame were generated snow, hail and extreme cold. The water that fell in rain was acid and corrosive; destroying cattle and men—covering the bodies of cattle with pustles and ulcers, and excoriating the hands and faces of men when it fell on them. It also killed vegetables. The effects were felt not only in Iceland, but in Norway, and other parts of Europe.

Had this treatise fallen into my hands some months ago, I might have been able to illustrate particular parts of my theory by authentic facts, taken from that work. As it is, I must content myself with observing, that Mr. Holm's observations verify my ideas, respecting the agency of electricity in producing pestilence, and extremes in the seasons. On this theory not only pestilence, but severe cold, and extreme heat, hail and snow are all familiarly explained, and their connection with volcanic eruptions, and other electrical operations, visible and invisible, demonstrated.

## SECTION XI.

*Pestilential periods exhibited by means of an increase of mortality  
in distant parts of the world.*

AS there are certain periods when particular epidemics prevail over the world or over a hemisphere, and when all other diseases assume peculiar malignancy, I have here subjoined a number of bills of mortality, for different and distant places, to show the effect of the general principle of disease in remote countries or towns.—Some of these periods appear in the foregoing tables, as that between 1623 and 1627; and between 1631 and 1637.—

A similar period occurred between 1718 and 1721.

A. D.	BURIALS IN			
	London.	Amsterdam.	Vienna.	Breslaw.
1716	24,436	7078		
17	23,446	7451	5205	1458
18	26,523	8644	6110	1255
19	28,347	9726		
20	25,454	7820	6825	1816
21	26,142	7632	6490	1482

The plague raged in Turkey and Syria in 1718-19 and 20, also at Marfeilles in 1720, in which years or one of them, the bills of mortality were swelled, even in the north of Europe, I regret that some of the bills are deficient.

The period from 1725 to 1732 is equally remarkable.

A. D.	BURIALS IN		
	London.	Amsterdam.	Dublin.
1725	25,523		
26	29,647	9,275	2763
27	28,418	13,775	2946
28	27,810	11,164	
29	29,722	9,618	3206
30	26,761		2184



Plague in Egypt and the Levant during this period.

From 1739 to 1743.

BURIALS IN					
A. D.	London.	Amsterdam.	Dublin.	Boston.	Church in Phila.
1739	25,432	7566	2201	554	97
40	30,811	10,066		704	98
41	32,169	9864	2790	555	162
42	27,483		2320	517	123
43	25,200		2193	620	116

Plague in Levant, Italy and America.

From the year 1744 to 1757 there were many sickly years, but no one distinct period when an increase of mortality is observable in all parts of the world, at the same time.

From 1758 to 1764.

BURIALS IN					
A. D.	London.	Amsterdam.	Dublin.	Boston.	Church in Phila.
1758	17,576		1558	524	129
59	19,604		1752	629	271
60	19,830	7700	1993	576	174
61	21,063	7720	2292	456	144
62	26,326	8412	2490	531	200
63	26,143	9876*	2605	407	180
64	23,202	8585	2307	548	138
65	23,230	7725	2275	560	186

Plague in Egypt and the Levant from 1758 to 1763. Yellow Fever in Philadelphia in 1762.

From 1770 to 1773.

BURIALS IN					
A. D.	London.	Paris.	Amsterdam.	Boston.	Church in Phila.
1770	22,434	18,719		483	127
71	21,770	18,941	7983	482	139
72	26,053	20,374	10,609	517	157
73	21,656	18,518†		595	179
74	20,884			596	161

Plague raging in the east.

\* This bill is stated in the Annual Register at 10,506.

† In Anderson's History of Commerce, Continued, vol. 5. 223, the number of deaths in Paris in 1773 is stated to have been 28,518.

The series of epidemics, in this period, measles, influenza and fore throat, were followed by dysentery in America from 1775 to 1777 inclusive, the mortality of which will appear from the following bills.

## BURIALS IN

A. D.	A Church	Phi.	Hartford.	Litchfield.	Trinity Church Boston.	Total.
1774	161		31	27	24	243
75	156		74	31	48	309
76	180		79	82	30	371
77	222		72	120	48	462
78	183		58	32	63	336
79	142		49	34	35	260

It is probable the mortality in the northern states of America was every where in that proportion. The same disease made similar ravages between 1749 and 1753—in 1759—1765 and 6—in some places in 1769.—It was remarkably mortal in 1773. This latter year was in America unhealthy. In Salem, Mass. the bill of 1773, was raised to 208, (double the usual amount) by the dysentery. The bill for St. Petersburg in Russia, was swelled in 1773, one fifth, and in 1777, one fourth.

The last epidemic period, save one, was from 1781 to 1787 inclusive. The diseases were influenza, measles and scarlatina. These were in general lighter than usual. In the interior of New-York state, Vermont, Massachusetts and New-Hampshire, the scarlatina was more severe and mortal; but on the sea board and especially in Connecticut, it was milder, and many places wholly escaped it. Yet every where the bills of mortality were swelled in 1783, 4, 5 or 6, when the plague was raging in the Levant and Egypt. This period was closed by remarkably cool summers, and no dysentery or pestilential fever of any considerable violence or extent, succeeded.

## BURIALS IN

A. D.	Episco.	Trin.	Hart-	Weth-	Church	Chur.	ford	ers-	Litch-	Guil-	North-	To-
	Philad.	Bosto.	Con.	field.	field.	ford.	Haven.	tal.				
1779	142	35	49	25	34	17	11	303	health.			
80	155	44	36	17	24	25	10	311	health.			

1781	179	41	37	20	35	17	15	344	influenza.
82	198	39	34	31	34	18	9	363	do. Europe:
83	232	56	42	46	42	19	8	445	measles
84	230	61	33	31	34	22	15	426	& angina.
85	166	41	44	24	30	18	6	329	angina.
86	156	49	50	37	36	19	9	356	angina.
87	147	32	37	19	34	24	8	301	health.

The scarlatina and measles produced their principal effects, it will be observed, in Philadelphia and Boston. The plague raged in Egypt principally in 1783 and 4, and the scarlatina appeared in Britain, but without very considerable mortality. In 1787 the plague prevailed in Egypt and on the Barbary coast; and diseases of the throat were prevalent in England and some parts of America.

Last epidemic period from 1789 to 1797 inclusive.

#### BURIALS IN

A. D.	Phila- delphia.	Episco.		Presby.		Ger Lu.		Total.	
		Ch. N.	Ch. N.	Ch. N.	Ch. N.	Ch. N.	Ch. N.		
1789	1027	337	109	59	59	1532			measles and influenza.
90	888	310	107	52	52	1357			influenza.
91	1290	257	84	60	60	1691			fever began New-York.
92	1497	404	121	66	66	2088			scar. began, plague Egy.
93	5304	467	101	76	76	5948			scarla. pesti. hot & dry.
94	1135	413	71	71	71	1690			some fevers, tempe. sum.
95	2274	554	137	71	71	3040			pestilence, hot & humid.
96	1602	540	186	62	62	2390			pestilence New-York.
97	1689	399	130	51	51	2269			pesti. Phil. cool summer.

The results above are not perfectly accurate, for the bills in Philadelphia, it is understood, are from August to August; those in New-York commence with the year. The bill of the Presbyterian Church in New-York, for 1797, is by estimate; the others are taken from registers.

View of this epidemic period in Connecticut:

A. D.	Two Soci. Hartford.	N. Haven City.	Guil- ford.	Litch- field.	Wethers- field.	North- Haven.	Corn- wall.	South- ton.	N. Lon- don.	Oxford- Derby.	Total.	
1789	48	51*	20	33	35	10	6	17	38	21	299	meas. &c
90	38	50*	20	54	36	10	10	24	81	18	341	(influen.
91	41	50*	21	41	20	4	6	10	60	17	270	health.
92	41	51	15	23	37	7	8	12	51	12	257	health.
93	65	70	29	80	40	18	10	20	70	11	413	scarlatin.
94	109	180	54	56	47	32	19	34	60	39	630	do & fever
95	88	159	55	35	34	15	9	15	86	11	507	dysentery
96	75	67	19	40	42	12	15	27	80	14	391	measles.
97	59	58	25	40	18	7	8	17	101	12	345	health.

It will be observed that the principal effect of the epidemics, was in 1794, except in Litchfield, in the western part of the state.

\*\*\* Note.—The number of deaths in New-Haven for 1789, 90 and 91, is set down by estimate, the other bills are from registers.

View of the same period in Boston and the neighborhood :

A. D.	Dr. La- throp's	Late El-Dr.	Stone Bel- Tri.	Char- les- Chap- man.	Salcm. town.	Total.	
1789	52	37	10	50	10	129	310 influenza.
90	51	40	8	46	14	203	397 do. & meas.
91	34	37	8	31	16	148	300 health.

1792	43	46	16	50	32	148	32	377	do. ex. sm.
93	24	30	11	44	22	148	32	312	do. [pox.
94	45	43	12	33	22	122	26	303	do.
95	34	37	12	45	28	195	38	389	scarlatina.
96	37	34	16	50	28	216	65	446	scarla. fev.
97	37	25	10	47	22	147	49	337	health.

Let it be noted that the effect of the scarlatina was here in 1795 and '96. The progress of the disease is distinctly marked to be from New-York eastward, from 1793 to 1796. The scarlatina in 1785 and 6, was most severe in Massachusetts—that in 1794, in Connecticut. The bills in Boston for 1792 were swelled by the small-pox by inoculation, which is not to be taken into this account of epidemics. The year selected was rather unfavorable, as the condition of the atmosphere was inflammatory, and inclined to produce eruptive complaints. The scarlatina was then making its appearance in the middle states. The spring of 1793, when inoculation was begun at Hartford, was still more unfavorable; and the small-pox was so unmanageable as to surprise the faculty. The principles unfolded in this treatise will solve the difficulty.

By a bill of mortality for Madeira, it appears that the pestilential principle of the years from 1760 to 64, extended to that healthy island.

A. D.	BURIALS.
1759,	1136.
60,	1356.
61,	1746.
62,	1366.
63,	1118.
64,	1325.
65,	1267.
66,	1037.

The following bills for several religious societies in Connecticut, will exhibit a general view of epidemics from the year 1750.



A.D.	Gulfport 1 society.	Hartford 2 societies.	Litchfield 1 society.	Middletown 1 society.	New-Haven 1 society.	
1750	19	—	—	—	—	dysentery and angina for 3 or 4 years.
51	65	64	—	—	—	
52	28	—	—	—	—	
53	25	29	—	—	—	anginas.
54	15	20	21	—	—	anginas in some places.
55	22	33	16	—	—	dysentery in many places.
56	46	32	28	—	—	catarrh.
57	17	30	12	—	—	measles.
58	17	36	15	—	—	measles, dysentery and fevers.
59	20	48	28	—	—	
60	29	36	24	—	—	influenza.
61	18	42	16	—	—	plague Philadelphia.
62	18	34	22	24	—	
63	18	34	16	22	13	
64	28	42	25	25	19	dysentery.
65	15	24	22	35	17	

A. D.	Guliford 1 society.	Hartford 2 societies.	Litchfield 1 society.	Middletown 1 society.	New-Haven 1 society.	Wethersfield 1 society.	Cornwall.	
1766	12	46	17	29	20	—	—	dysentery in some places.
67	20	34	22	26	15	—	—	
68	21	17	31	30	21	—	—	
69	43	27	19	27	31	—	—	angina and dysentery, measles.
70	14	34	18	41	15	—	—	angina, measles.
71	10	32	35	38	18	—	—	catarrh, angina.
72	17	33	36	38	19	—	—	influenza and measles.
73	35	32	36	39	42	—	—	measles, angina, dysentery.
74	13	31	27	30	21	—	—	
75	29	74	31	63	21	59	10	} angina and dysentery very fatal.
76	32	79	82	78	31	59	20	
77	29	72	120	42	14	40	21	
78	21	58	32	37	15	27	3	
79	17	49	34	19	21	25	13	
80	25	36	24	35	12	17	6	
81	17	37	35	37	15	20	16	influenza.
82	18	34	34	45	21	31	8	influenza in Europe.

A. D.	Gulfport 1 society.	Hartford 2 societies.	Litchfield 1 society.	Middletown 1 society.	New-Haven 1 society.	Wethersfield 1 society.	Cornwall	
1783	19	42	42	70	12	46	17	measles, angina began, but
84	22	33	34	41	12	31	8	scarcely perceived by the
85	18	44	30	40	17	24	5	burials in Connecticut.
86	19	50	36	28	23	37	4	
87	24	37	34	26	20	19	20	
88	23	45	27	24	41	22	4	
89	20	48	33	43	14	35	6	measles, influenza.
90	20	38	54	34	26	36	10	measles, influenza.
91	21	41	41	30	12	20	6	} some fevers, but no epidemic.
92	15	41	23	24	11	37	8	
93	29	65	80	35	12	40	10	angina, fevers.
94	54	109	56	28	50	47	19	angina, fevers.
95	55	88	35	16	38	34	9	fevers.
96	19	75	40	35	8	42	15	measles in many places.
97	25	59	40	25	14	18	8	health in general.

From the bills of mortality and preceding history may be deduced some interesting observations.

1. We observe an order and progression in the epidemics, which is in a degree uniform. Periods of pestilence, with some exceptions, seem to be introduced by measles and influenza; then follow diseases of the throat, or anginas; lastly pestilential fevers. During the whole period, the measles, influenza and angina, occasionally appear in spring, autumn and winter; and rarely, if ever, does a pestilential fever, as plague and yellow fever, occur in a particular city or country, without influenza, angina, measles or inflammatory fevers in the spring preceding, for immediate precursors. This is true in the tropical climates, in cases of epidemics; and so uniform has been the fact in the temperate latitudes, that I am nearly prepared to say, that if none of those precursors appear in winter and spring, no pestilential fever will be epidemic in the following summer and autumn, unless the dysentery may be excepted. It holds true in every case of *great* pestilence.

2. The progressiveness in the pestilential principle is obvious in the augmented bills of mortality, which immediately precede the plague. This arises from the number and violence of the malignant diseases which always precede an epidemic pestilence. This augmentation is visible some times two years before the plague appears, and almost always in the spring months preceding. See the London bills in the years preceding the plague in 1625—1636—1665. The same is observable in other bills, both in Europe and America. In a few instances, the bill of the preceding year is low; but in this case, some other epidemic has usually gone before, and finished its course; or the plague is preceded by influenza only, which does not swell the bill of mortality.

3. Sometimes a series of epidemics falls with more violence on one hemisphere than on the other; but perhaps in no instance has a course of diseases spread over one continent, without showing themselves on the other. I have not been able to find an instance in which the plague has made great ravages in the east, except when the American continent has been more or less affected by the epidemics above mentioned; and in some instances it is proved that the violence of the sore-throat, influenza, measles or

yellow fever, in America, has corresponded with the violence of pestilence in Egypt and the Levant. The commencement of each period of epidemics is nearly cotemporary, in both hemispheres.\*

Thus the great plague in Constantinople was cotemporary with the fatal angina and dysentery in America in 1751—also in 1755. Cotemporary with the measles in America in 1758 and 9, was the commencement of the extensive Levant plague of 1760. Pestilence in Persia was cotemporary with the epidemics of 1773—In 1783 commenced plague in the east and epidemics in America—the same in 1792 and 3. Diseases of the throat in almost every instance prevail at the same time in Europe and America.

4. In two periods within half a century, a severe angina and dysentery have been epidemic together and once for a series of years, as in 1751, and from 1773 to 1777. This is an exception to the usual order, and other deviations sometimes occur.

5. As catarrh precedes, so it follows every severe epidemic pestilence, and the persons who have been affected with a pestilential fever in summer, are most apt to be affected by catarrh at the commencement of cold weather.

6. After severe pestilential fevers in summer, the inflammatory fevers of winter, wear the livery of the summer fevers. They generally carry with them bilious discharges, and a yellow skin. They have also this remarkable character, that they speedily run through the inflammatory diathesis, and become typhus. They are the *pestilence of winter*; and sometimes appear *before* the pestilence of summer. This fact alone decides the question, that pestilential fevers of summer are generated on the spot where they exist; and derive their malignant and infectious quality solely from the state of the elements.

This species of inflammatory fever has occurred in many cases during the winter months, since the year 1790. In some cases it has extinguished three, four and five members of a family; as

\* It sometimes happens that pestilence occurs in Constantinople, Smyrna or Cairo, when it is not epidemic beyond those cities; owing to peculiar seasons and local causes. But it never spreads to Syria, the islands of the Archipelago, and other neighboring countries, except when epidemic diseases spread over the world. At least I have not found an instance.



in Hartford and New-Haven. But it is a most consoling reflection, that it is less frequent than formerly in this country. It has not been epidemic in the northern states since 1761, as far as I can learn. Formerly it was as frightful a calamity as the yellow fever is in this age. In the foregoing history, many examples have been mentioned—as at Fairfield in 1698—at Waterbury in 1713—at Hartford and Duck Creek in 1720—at Farmington in 1729—at Bethlem, Hartford, East-Haven and New-Haven in 1761—at Holliston in 1753, &c. Whether the disappearance of this disease is owing to the clearing of the country, by which the quantity of debilitating miasmata of summer has been diminished, or whether it is the consequence of other alterations in our climate, is not easily determined.

The disappearance of the Long Fever, so called, is another most consoling circumstance. This species of typhus fever was formerly one of the most terrible diseases of our climate. At present it is a rare occurrence.

On the whole, we have very clear proof that the *quantity of disease* in this country, has been diminished, within half a century. The yellow fever, that is, the pestilential fever of summer and autumn, was formerly as frequent and as malignant as in this age; while the inflammatory fevers of winter, and the long fever, have almost disappeared as epidemics. The intermittents and remittents of autumn, are greatly decreased in the northern states; and the dysentery has not increased in frequency or virulence. Anginas have never been so fatal as they were between 1735 and 1743.

It is probable that some of these changes in the character of diseases may be ascribed to alterations in our climate, or modes of living—and therefore may be permanent. In some cases, improvements in medical science and the practice of physic may have disarmed diseases of their terrors. But it is possible that some of the changes mentioned are only revolutions in disease, occasioned by temporary causes, and that the same disorders may, in future periods, recur, with the whole train of formidable symptoms.

*Note.*—It has been observed that the *long fever*, so called, has nearly disappeared from our climate. On further enquiry, it appears that this observation must be restricted to the maritime states. The bilious remitting fever that prevailed in Vermont and New-Hampshire in 1798, and which has re-appeared in this summer (1799) is of that species. See Medical Repository, vol. 3. 5. In the *interior* of our country, this is a new disease; while on the sea-coast it has become extinct. Shall we conclude from these facts, that the disease follows or springs from a particular state of cultivation? In the interior, where the disease is now prevalent, the clearing and cultivation of the country were begun about 30 years ago. On the sea-coast, where the disease has disappeared, the country has been settled 150 years, and is generally under cultivation.

## SECTION XII.

*Of the Influenza, or Epidemic Catarrh.*

AS the catarrh appears to be the disease which is most closely connected with pestilence, and the least dependent on local causes or the sensible qualities of the air, I have collected all the well-defined instances of this epidemic which have occurred to my researches, and arranged them in chronological order; placing against the year the most remarkable physical occurrences, and mentioning those which fell within the years next preceding and following:

A. D.

CATARRH EPIDEMIC IN

- 1174, the year *before* an eruption of Etna, and followed by great mortality. [Chasm in the accounts of this disease.]
- 1510, the *same* year with an eruption in Iceland, and following great earthquakes. Humid air—a comet appeared the next year. [Chasm.]
- 1551, the year *after* an eruption of Etna, and a comet. Season wet.
- 1557, the year *after* an eruption of Etna. Season mostly wet; but in some countries dry; a comet the same year. [Chaf.]
- 1580, the year *after* an eruption of Etna. Cool dry north wind—A comet.
- 1587, the *same* year with an eruption in Iceland—and *after* a comet.
- 1591, *after* earthquakes in 1590, and a comet.
- 1597, the year *after* earthquakes and a hard winter; rainy season, and a comet the same year.
- 1602, the year *after* earthquakes, volcano and severe winter. Cold and wet season.

- 1610, the year *after* an eruption of Etna, a comet and severe winter. Season very hot and dry. [Chasfm.]
- 1647, First catarrh mentioned in American annals. The same year with violent earthquakes in South-America. A comet.
- 1650, In Europe the *same* year, with an eruption of Etna and earthquakes.
- 1655, in America, same year with violent earthquakes in South-America, and eruption of Vesuvius.
- 1658, in Europe, after a severe winter ; summer cool.
- 1675, in Europe, *while* Etna was in a state of explosion ; mild winter.
- 1679, 80, in Europe, *during* or just after the eruption of Etna ; wet season and a comet.
- 1688, in Europe, *same* year with an eruption of Vesuvius, after a severe winter and earthquakes ; this began in a hot summer.
- 1693, in Europe, *same* year with an eruption in Iceland, and great earthquakes ; cool season.
- { 1697, 8, in America, after a great earthquake in Peru ; a comet the same year, and severe winter.
- { 1699, in Europe, in spring ; great earthquakes the same year, and a comet.
- 1708, 9, in Europe, in a severe winter, *after* a comet and volcano.
- 1712, in Europe, the *same* year with an eruption of Vesuvius and a comet ; wet season.
- 1717, in Europe, the *year* of a comet, eruption of Vesuvius, and a severe winter.
- 1729, 30, in Europe, the *same* year with an eruption in Iceland and Vesuvius ; dry summer ; a comet.
- 1733, universal, after a comet, a severe winter and great earthquakes.
- 1737, in Europe and America ; an eruption of Vesuvius, great earthquakes and a comet.
- { 1743, in Europe, violent earthquakes.
- { 1744, a comet ; earthquakes.

1747, in America and Europe, with a comet and eruption of Etna.

1755, in Europe, with violent earthquakes and eruptions of volcanoes, and severe winter.

{ 1757, in America, soon *after* a comet, and followed by an earthquake.

{ 1758, in Europe, followed by earthquakes the next year.

{ 1761, in America ; an earthquake during its prevalence.

{ 1762, in Europe, *before* an eruption of Etna ; a comet the same year.

1767, in Europe ; an eruption of Vesuvius the *same* year, and of Etna and Heckla in the preceding year, with a comet and earthquakes.

1772, in America, *after* an eruption of Vesuvius and Heckla, and a severe winter.

1775, in Europe, preceded by earthquakes, small eruption of Lipari the same year, and in New-Spain.

{ 1781, in America, the year *after* an eruption of Etna, and a most rigorous winter.

{ 1782, in Europe and Asia, the year *before* the great eruption of Heckla.

1788, in Europe, soon after eruptions of Vesuvius and Etna, and earthquakes.

1789, in America, with an eruption of Vesuvius, just *after* a great earthquake at Iceland and in Europe ; warm summer ; mild winter followed.

1790, in America, after a mild winter.

1795, in England, *after* an eruption of Vesuvius and a severe winter.

1797, in Europe, *after* earthquakes ; a comet the same year.

The accounts of the seasons are mostly from English writers, and refer to England, with some exceptions. In regard to heat and cold, the seasons are generally uniform in most countries, on the same continent ; but not in regard to drouth and moisture.

Of these forty-four instances of influenza, it may be observed, from the preceding history,



1. That most of them happened, after or during severe cold, or during moist weather, and in spring, winter or autumn. Some however, occurred in dry hot seasons, and others in mild winters.

2. Nineteen instances occurred in years when there was a volcanic eruption in Italy or Iceland, and eleven others, though in different years, were within a few months of eruptions; making 30 out of the 44. Two or three others happened near the time of volcanic discharges in South-America.

3. Almost all happened in years of earthquakes, or within a few months preceding or following them.

4. Thirty instances occurred within the year, or a few months preceding or following the appearance of comets.

It is further to be observed that some of these epidemics have been limited to the American hemisphere, at the distance of three, four or five years from an epidemic of the same kind in Europe. Such as those of 1647—1655—which coincide in time with violent earthquakes in South-America.

In other instances this disease spread over the whole globe; usually beginning in America: That is, in the instances of which I can obtain any correct information. Thus in four instances, viz. in 1698, 1757, 1761 and 1781, it spread over the American hemisphere one year prior to its pervading the other hemisphere. And the universal catarrh of 1733, which encircled the globe, commenced in America two months before it appeared in Europe. The epidemic of 1782 invaded Europe from the side of Asia, the year after it appeared in America. In 1788, the influenza in Europe preceded the same disease in America.

I regret my want of materials to complete a view of this subject. No regular register has been kept in America, of the seasons, diseases and phenomena, from the first settlement, and whether any notices of all the catarrhs in this country, are in existence, I do not know. I have found no account of any, between 1655 and 1698—nor between the latter year and 1733. One of these instances, that in 1698, came to my knowledge by accident, as I have mentioned under that year, in the foregoing history. From the uniform appearance of this epidemic as often as

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once in ten or twelve years, in other periods, we have ground to believe, it has always occurred in nearly the same periods.

This epidemic is evidently the effect of some insensible qualities of the atmosphere; as it spreads with astonishing rapidity over land and sea, uncontrolled by heat or cold, drouth or moisture. From these circumstances and its near coincidence in time with the violent action of fire in earthquakes and volcanoes, there is reason to conclude the disease to be the effect of some access of stimulant powers to the atmosphere by means of the electrical principle. No other principle in creation, which has yet come under the cognizance of the human mind, seems adequate to the same effects. I do not consider earthquakes and volcanic eruptions as the *causes* of this epidemic, but as effects of the common cause and evidences of its existence.

The courses of this epidemic are very various. That in 1510 proceeded from Africa to Sicily, Italy and the north of Europe. This disease could not be the effect of the eruption in Iceland; for it appeared first in southern latitudes. If there was a volcanic discharge about that time in Africa, we might be inclined to ascribe the disease to that cause; but it is more probable that it is to be ascribed to an insensible action of atmospheric fire,\* which is more general and violent, about the time of eruptions; and which fire is probably agitated in all parts of the globe, although it produces visible effects in explosions, in some particular places only. I think no man can question the fact, after reading the preceding history.

The course of the epidemic in 1551, I am not able to ascertain; nor that in 1557. This invaded Spain in August.

The severe catarrh of 1580 began in the south of Europe, in the heat of summer, and proceeded to the north. The season in general was temperate.

From that year to 1708—9, I find no account of the course of the epidemic catarrh; but that in 1708—9, began in the north of Europe and proceeded to the south.

The epidemic of 1729—30, proceeded from Poland and Si-

\* I use this word to express the principle manifested in electrical operations, although this is usually supposed to be a cold fusion. Of the nature of this principle, we know little. We see only its effects.

lesia, to the west and south, and ended about the time of an explosion from Vesuvius.

The universal influenza of 1733, began in America in the autumn of 1732. It appeared in Europe in December. That of 1788 appeared in April, May, June and August, in different places.

The epidemic in America in 1789, began in the middle states, and spread southward and eastward. In 1790, it began in about the same longitude, but in the interior country, and spread eastward and southward.

The influenza of 1782 in Europe, came from Asia. Possibly it might have travelled from America, across the Pacific to China and Kamschatka; as it was epidemic in America in 1781.

This is all I am able to discover of the origin and direction of this singular epidemic. It is greatly to be desired, that we might learn precisely the dates of its appearance, the place, the direction of its progress, in all cases, and compare these circumstances with the extraordinary agitations of the elements, which occur about the same time. But for this purpose my materials are incomplete.

It is observable, however, that the influenza is closely allied to the measles. Sometimes the symptoms are combined in the same attack, and rarely does one disease become epidemic, except just before or after the other. This proves their alliance: indeed I consider them as different modifications of the same epidemic.

Catarrh is also closely connected with pestilential fevers, and sometimes this is true of the measles. It is rare indeed that epidemic plague and yellow fever do not begin and end in catarrhal affections—that is, catarrh precedes in spring, and follows in autumn. Sometimes pestilence is preceded and followed by measles and angina.

Every epidemic constitution seems to commence with measles or influenza. To these succeed angina, in some of its various forms, which are all the offspring of the same parent. Then follow pestilential fevers, in the form of dysentery, yellow fever and plague. Whenever the epidemic constitution is manifested by measles, influenza and affections of the throat, common diseases,

even in places apparently healthy, become more malignant, and sporadic cases of pestilential fever occur in almost every situation.

These facts are curious, and without attending to them, the philosophy of epidemics cannot be understood.

P. S. After writing the foregoing history, I was able to ascertain further particulars of a severe influenza in America in 1737. Warren, on the yellow fever, mentions this catarrh in Barbadoes in the winter preceding the bilious plague in that island in 1738. I have now learnt from two elderly gentlemen, who were then arrived to adult years, that in November 1737, this epidemic invaded all parts of the country, so suddenly and severely that neighbors could not visit each other, and that there were scarcely people in health to perform the ordinary domestic labors necessary to support life.

If my informants are correct as to the time, this epidemic invaded Europe and America in the *same month*—the only instance that I have found; and an exception to the foregoing remarks. It will be observed also that this instance coincides with an eruption of Vesuvius, and the most tremendous tempest in the East-Indies ever known. Let it be noted also, that this catarrh was the *immediate precursor* of the most fatal pestilential fever in the West-Indies, and one that nearly depopulated Mexico. The catarrh commenced with or a little before a most severe winter.

It is remarkable that the extent and violence of this distemper mark exactly the severity of the pestilential fevers which precede and follow it. The two epidemic catarrhs of 1733 and 37, invaded the whole globe in the same year. They were very severe, and so were the anginas and plagues of this period; far beyond what has occurred at any other time, during this century, until the last period.



## SECTION XIII.

*Of the order, connection and progression of pestilential epidemics.*

**I**N the early periods of the world, little notice appears to have been taken of a connection between epidemic diseases; nor have modern writers supplied this defect in the history of medicine. Hippocrates and Sydenham seem to have been aware of such a connection, and the latter author has laid a broad and firm foundation for a complete system of truth, on the subject of epidemics. His observations were confined to the city of London. Had he extended his view to all parts of Europe, and generalized his observations, he would have found a multitude of facts to justify his theory, and probably would have raised it above the reach of that obloquy and ridicule, which succeeding professors of physic, of less genius and learning, have cast on his occult qualities of air.

Indeed, it is surprising that medical men have not pursued the ideas suggested by these great fathers of their science. Hippocrates led the way, unlocking the great doctrine of a constitution or state of the atmosphere, calculated to produce particular epidemic diseases; a doctrine which Sydenham has pursued with wonderful success. Any man who reads the history of diseases, must see that certain species of them appear nearly together in time and place. The order in which they appear, may not be exactly the same at all times, and in all countries; but they occur so nearly together, as evidently to prove their alliance, and their dependence on the same general causes.

All popular diseases must have, for their causes, some principles as extensive as the effects. These causes most probably exist in the elements, fire, air and water; for we know of no other medium by which diseases can be communicated to whole communities of people.



Bad food indeed is a fruitful source of diseases; but this must always proceed from the qualities of the elements which enter into its composition. A defect therefore in the nourishing powers of food, is a consequence of a defect or superabundance in the elements, or in their combination in animal and vegetable productions. It may be considered as a disease in the animal and vegetable kingdom, which most probably proceeds from the same causes, as epidemic distempers among mankind.

The principal epidemic distempers which invade mankind, are, catarrh or influenza, measles, whooping or chin cough, the different species of agina, small pox, billous fevers, petechial fever, dysentery, plague. Of these, catarrh is the most decidedly an epidemic dependent wholly on a particular state of atmosphere. Cullen calls it "catarrh from contagion," to distinguish it from sporadic cases of the same disease; but, after careful observation, during the progress of it in the United States in 1789, and again in 1790, I am confident the progress of the disease depends very little on a communication from person to person. It has been doubted whether it is an infectious disease; and I have some evidence to prove it not so; but certain it is, that its sudden invasion of whole families, whole towns and even whole countries, and the rapidity of its progress over sea and land, absolutely preclude the supposition of its dependence on specific contagion.

The other diseases above enumerated may arise from both causes—infection and a peculiar state of air. Some of them depend mostly on a constitution of air, fitted to produce them; others are seldom produced without a connection with diseased persons. It is however proper to observe that the small-pox, dysentery and plague are not usually, and in strictness of language, epidemic diseases.—They seldom invade whole countries. They are more properly *endemic*; yet this epithet is not strictly applicable to them; being used more properly to denote a disease which is *peculiar* to a particular place, whereas those diseases may invade any place on the globe. The elephantiasis is an *endemic* in Egypt and certain other places in warm climates; the small-pox, dysentery and plague usually appear in cities, camps, or

other unhealthy situations, without affecting neighboring places, which contain not the same local causes of disease. They might therefore, in strict propriety, be denominated *temporary epidemics*, in opposition to *epidemics* which spread to all places alike; and to *endemics*, which *constantly* or *usually* appear in particular parts of the world.

This distinction however is not very material; and I shall therefore speak of the small-pox, dysentery and plague, as epidemic diseases; meaning by this epithet, that they, at certain times, spread generally over a particular town or region.

The nature and kinds of contagion will be more particularly considered, in a subsequent section; the present subject, is, the order, connection, and progression observable in pestilential epidemics.

The influence of a certain state of air in generating epidemics was observed by Hippocrates, who has described the prevalent diseases, in different seasons. In his second section on epidemics, he describes what he calls "*Katastasis loimodes*," a pestilential state of the air or seasons. He does not indeed in this passage mention the *plague*, but he speaks of those malignant diseases which are, in modern times, the precursors of the plague, and which are now produced by the state of weather which he describes.

This state of the seasons he represents thus, "The year was austrinus, remarkable for southerly breezes, rainy and without winds. The first part of the year dry, and autumn rainy, with southerly winds, humid and cloudy. In winter, southerly winds, moist and mild weather. About the vernal equinox, severe cold, but the north winds, with snow, were of no long duration. Spring was again calm, southerly weather—great rains continued till August—then clear hot weather—the cool Etesian winds blew but little and for short periods. A rainy autumn, with north winds."

The southerly, hot, humid air here described, whenever of long continuance in summer, proves the cause of numerous malignant diseases, in the United States, as well as in Europe, altho not certainly productive of pestilence.

Hippocrates proceeds to mention the diseases which prevailed in this state of seasons. "Before spring, even during the cold weather, appeared many erysipelous diseases of a malignant type. Diseases of the fauces, accompanied with hoarseness, ardent fevers, with phrenitis; ulcers in the mouth; inflammation of eyes, carbuncles, &c. These diseases spread and became epidemic and mortal." The author then proceeds to describe the erysipelas and other diseases here named. These cases differ from the plague in Athens; and prove that the pestilence in Thasus, where he wrote, was of milder symptoms, though probably cotemporary with that epidemic in Athens.

My particular reason for reciting these passages from Hippocrates, is, to prove a progressiveness in a pestilential state of air, and the diseases which it produces. The diseases here mentioned are the same, substantially, as those which *precede* the plague in modern times, in the countries bordering on the Mediterranean, and with little variation, the same with those which precede the plague in all parts of the world. Erysipelous, or other eruptive diseases, catarrhus affections, or ardent fevers, are the constant precursors of the plague, wherever it appears. Hippocrates does not mention any fatal plague, in the state of air described; and it often happens, at this day, that the strength of the pestilential principle is arrested in its progress, and the epidemics are limited, in their violence, to diseases of a type less malignant than the true plague, or arising to the plague only in a few scattering cases. But whatever may be the degree of the pestilential state of the air, or at whatever point, it may be destined to cease, and yield to a more salubrious constitution, the class of diseases which mark its rise and progress, are always similar, or the same, modified only in the violence of their symptoms, by accidental circumstances.

A careful attention to these facts, cannot fail to convince the observer of the justness of Sydenham's doctrines, in regard to constitutions of air; and the facts themselves demolish, at one stroke, all the common medical doctrines of the communication of pestilence from place to place by contagion, or fomites.

Unfortunately, the histories of ancient plagues furnish but

little light on this subject ; yet the barren annals of antiquity and the middle ages, are not wholly destitute of evidence to this point. The progression of the plague in Rome, growing more general and fatal to the second and third year, is a fact recorded by Livy, and is related in the preceding pages.

The remark of Dion Cassius, that the ashes from Vesuvius, in the great eruption of 79, produced, that year, only slight diseases, but the next year, an epidemic, has already been noticed. It leaves no room to question, that the destructive plague of the year 80, was preceded by epidemic disorders of a less malignant type.

The middle ages furnish facts in confirmation of this doctrine. Witness the great plague in 1112, which was preceded by erysipelous diseases in England in 1109, and great mortality in 1111. The plague of 1242, which was preceded by great mortality in 1240—the same fact is observable in the pestilence of 1252, 1368, 1379, 1390, 1517, 1527, 1575, 1636—and in many other instances.

This fact did not escape the notice of that accurate observer of nature, Lord Bacon, who lived at a period when the plague frequently infested England. He says, “The lesser infections of the small-pox, purple fever, agues, &c. in the preceding summer, and hovering all the winter, *portend a great pestilence the following summer*, for putrefaction rises not to its height at once.” Works, vol. 3, p. 59.

That state of air which produces pestilential diseases, Lord Bacon denominates *putrefaction* ; but whatever appellation we may give to the *cause* of pestilence, the remark is demonstrably well founded, that this “rises not to its height at once.” It is progressive ; producing first the “lesser infections.” The plague is rarely, if ever, an original, distinct, isolated disease ; but the last or most mortal form of a series of malignant distempers. The purple fever mentioned by Lord Bacon is nearly allied to the *petechial* fever, which is the usual precursor of pestilence in the Levant.

The universal plague of 1635, 6 and 7, was preceded by the  
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usual diseases, and the progress of them is distinctly traced by the learned Diemerbroeck. He remarks, chap. 3 de peste, that "the spring of 1635, was warm and moderately humid, to which succeeded a very hot, dry season, in which appeared many malignant epidemics. In the first place, a severe plague broke out at Leyden, and destroyed more than 20,000 lives. At Nimeguen, in Gueldres and other regions, a certain pestilent fever spread with dreadful mortality. In autumn, the severe heat still continuing with excessive drouth, many other malignant diseases appeared, as small-pox, measles, diarrhea and dysentery of a very bad type; but above all, the above mentioned pestilential purple fever, called in Italy *petechial*, increased daily in extent and violence, until it turned into the true plague—"donec tandem in aperuissimam pestem transiret."—The author goes on to remark that from November through the winter, scattering cases of plague occurred in Nimeguen. In January 1636, it increased, and in March spread and became epidemic—rose to its height in April, and continued till October. See pages 5 and 6.

This passage contains a number of important facts. First—the seasons were insalubrious. Secondly—the pestilential state of air extended to many places at the same time: In another page, the author says the pestilence spread over almost all Germany and the low countries. Thirdly—this state of air was of different degrees of malignity or violence, in different places at the same time. Thus, the plague appeared at Leyden early in 1635, but cotemporary with this, was the appearance of the purple fever in Nimeguen and in other places; and during the summer and autumn, this and other epidemics continued to rage with great mortality, and at last, the strength of the pestilential principle increasing, the fever changed its form, and appeared in the true plague.

Now, the modern way of accounting for the plague in Nimeguen, would be to *allege* or *suppose* some infected goods to have conveyed the contagion from Leyden, where it first appeared; and then to *suppose* the infection to be carried to Leyden from the Levant.

The philosophic Diemerbroeck, who was present and observed all the circumstances, *supposes* nothing. He relates plain facts



just as they occurred, and admits that the plague must have originated in the country.

By considering the malignant epidemics that prevailed at that time, as connected and depending on the same general cause, we solve all the difficulties attending the origin of the plague. The petechial fever, which appeared at Nimeguen and other places, in 1635, was *one of the forms* in which the general contagion of the period, exhibited its effects on the human constitution. It was a *part* of the pestilence—it could not be conveyed from Leyden, for it appeared in most parts of the low countries and in Germany, at the same time. The same general cause, an indisposition in the elements to support healthy life, produced various pestilential diseases, according to place, season, age, habit of body and constitution, until its strength and violence arose to their height, and gradually introduced the worst form of pestilence.

The idea of Diemerbroeck, that the purple fever “turned to the plague,” must give great offence to the followers of Mead and Cullen, the advocates for the doctrine of the propagation of the plague solely by specific contagion. It opposes efficaciously their whole theory, and levels it with the earth.

The fact is however indisputable. In the distressing period from 1569 to 1577, when Europe was almost depopulated by the spotted fever, physicians observed that this disease frequently turned into the plague, and the plague into the spotted fever. The same fact was often noticed by writers of the 16th and 17th centuries, in which the plague frequently overran Europe.—These two diseases, are therefore two distinct forms or modifications of pestilence—probably bearing an affinity to each other, like that between the distinct and confluent small-pox. This fact shows that the distinction made by medical writers, between *pestis* and *pestilentialia*, the plague and other pestilential distempers, however useful in practice, is not authorized by truth and philosophy. The ancients classed all contagious epidemics together, and denominated them *pestilence*; and this distribution, in regard to their causes and origin, was doubtless most philosophical. The distribution made by modern physicians, seems to have arisen out of differences of symptoms, and to be best adapted to practice. At

the same time, it has probably been the occasion of the common error of considering different species or forms of pestilence, as diseases of generical difference, and proceeding wholly from distinct causes, when in fact they all have *one general cause* in common, and the varieties of their symptoms proceed from *distinct local and temporary causes*.

On this subject the learned Riverius, in his *Praxeos Medicæ*, lib. 17. has many judicious remarks. He observes, "That authors, who wrote on fevers, distinguish a pestilent from a malignant fever—by pestilent fever they understand the true plague; by a malignant one, the fever vulgarly called *purple*, or other fever, which tho epidemic and contagious, is less dangerous, and in which more patients survive than perish—whereas the essence of the true plague consists in this, that it destroys more than half who are seized with it." He however considers these fevers as differing mostly in degree of malignity, and therefore treats of them under one head.

A pestilent fever this author considers as not proceeding solely from intemperate heat, or putridity; but from a malignant and poisonous quality; and whenever this quality appears in a fever, whether quotidian, hectic or putrid, he thinks it ought to be denominated *pestilent*. A pestilent fever differs from the plague as species from genus because there may be plague without fever.

This author remarks also the connection between certain epidemics. "Many deadly diseases accompany the prevalence of pestilence—as phrenitis, anginas, pleurifies, peripneumonies, inflammations of the liver, dysenteries and many others." He ascribes epidemics to the state of air, as a common cause, to which he adds the usual local or particular causes, which modify its influence.

Prosper Alpinus informs us that these diseases prevail also in Egypt, at certain times; but he gives no account of their order or connection. Vol. 2. p. 73.

Bellinus describes the phenomena which precede the plague, which he calls its *antecedents*. After mentioning food of a bad quality, impure air from exhalations, intemperate seasons, vapours emitted during earthquakes and the like, he says, "Mox

autem invasuram antecedunt morbi epidemici, qui cujuscunque generis esse possunt, febres petechiales, variolæ, morbilli, dysenterix, pleuritides epidemicae." De febribus, page 265.

This author does not here speak of these antecedents as *unusual* phenomena; but lays it down as a general fact, that spotted fevers, small-pox, measles, &c. become epidemic, just before the invasion of the plague.

Van Helmont observes that "he could never perceive a different pulse in the plague, from that in continual malignant fevers." p. 1138—no inconsiderable authority for the identity of the diseases in kind, however various in degree.

The great Sydenham took notice of the unusual prevalence of malignant distempers, just before the plague of 1665. In vol. 1, p. 122, he says, "I never knew pleurisies, quinsies and other inflammatory diseases, more common than they were for some weeks preceding the plague in London in 1665." These were the hybernal and vernal precursors of pestilence. As the season advanced and the weather became mild, these inflammatory diseases yielded to a malignant fever, described by the same author, and already mentioned in the preceding history, which was the immediate precursor of the true form of the plague, into which it changed by such insensible degrees, that Sydenham himself was at a loss to determine whether that fever was the plague or not, and was candid enough to acknowledge his ignorance. And as a further proof that this fever and the plague were only different forms of the same disease, we must notice the fact recorded by Sydenham, that when the plague in autumn began to abate, the same malignant fever re-appeared—see page 136: that is, the disease, by change of seasons, began to lose its glandular marks, and gradually to assume a less malignant type. Hodges mentions the same fact, and so does Morton.

In every instance of a severe plague, of which I can obtain a tolerably correct history, the disease has passed through a similar progression, and exhibited similar facts.

Thus in 1719, the year before the great plague in Marseilles, appeared a pestilential fever in that city, which, in some cases, produced buboes and carbuncles. That is, the plague actually

began to appear, six months before the arrival of the infection from Syria !

In Aleppo, the plague which appeared in 1742, was preceded by an acute fever ; and after the disease abated in July, appeared diarrheas and dysentery of a malignant type, attended in many cases with petechæ, and intermittents which often proved fatal. These diseases, in their acute forms, prevailed also with the plague, which in this year was not severe, nor wholly the predominant epidemic.

This continued acute fever and pleurifies, ran through the winter. In November appeared a few cases of the plague. Where the infection had lain dormant from July to November, the author of this account, Alexander Russell, has not informed us.

In the spring of 1743, the plague again appeared and spread in the city, and at the usual time in summer subsided, being again succeeded by other acute disorders, which by bleeding and purging, were formed into tertians, double tertians and quotidians.

Here again we have the same progression in the state of the pestilence, which had been remarked by Hippocrates, Bacon and Sydenham. During the existence of this pestilential constitution in Aleppo, all the ordinary diseases of the country assumed a more malignant type ; or as Sydenham remarked of the diseases which preceded the plague of 1665, they " differed from the same diseases in other years, by new and unusual symptoms, which in short amounted to this, that they were all *more violent*." See vol. 1, p. 20.

The diseases changed their form with the seasons—the acute fever preceding ran into plague, and plague ran into malignant dysentery, tertians, and other acute distempers.

Similar facts are observed in America. The plague has been preceded by acute diseases, as anginas, remittents of a bad type, &c. and followed by remittents, dysentery and malignant pleurisy.

The dreadful plague at Messina in 1743, which destroyed two thirds of its inhabitants, was introduced by a malignant fever. One physician alone out of thirty-three, pronounced it the plague ; the others denied it, because the disease was not attended with glandular swellings.



A similar fever preceded the severe plague at Venice in 1576, and the same uncertainty at first embarrassed the physicians and magistracy.

The terrible pestilence at Naples in 1656, was announced by the usual herald of the disease, a malignant fever. One physician alone pronounced it the plague, and for his audacity was imprisoned by the Viceroy.

The extensive pestilence which spread over all the Levant countries and islands, from 1759 to 1763, was every where preceded by a similar increase of malignant diseases, and especially by the petechial fever, which appeared, at Aleppo, in the year next previous to the plague. Yet the author of this account, Patrick Russel, labors very gravely to trace the disease to Turks from Egypt and their old clothes.

The uncertainty among physicians, at the commencement of a plague, with respect to the nature of the disorder, is a strong proof of the doctrine for which I contend. Van Helmont, Diemerbroeck and others have found it necessary to lay down rules with a great degree of care and caution, to enable themselves to determine, whether a malignant disease is the plague or not. Van Helmont observes, p. 1138 that he could perceive no difference in the pulse, in plague and continual fevers of the malignant kind—that buboes in the groin, parotides, &c. are not unfrequently found in fevers free from plague; and sometimes spots and carbuncles. But, says he, if many of these appearances do concur, there is no difficulty in pronouncing it the plague, especially if they appear before or early after the fever.

Diemerbroeck declares, that no one symptom determines a disease to be the plague—neither fever, buboes nor carbuncles are essential to that disease, for it often passes off without either—many of its symptoms are common to that and other distempers—the existence of the disease therefore is to be determined by a view of all the circumstances, and one criterion, he remarks, is, the prevalence of the plague in neighboring towns.

This last remark indicates that the author had observed the existence of pestilence in various places at the same time, to be a common event.



The difficulty at first in ascertaining the existence of the plague, proceeds wholly from the progression in the series of diseases—the malignant fevers, preceding gradually increasing in violence, and changing their form.

It has been the same in the United States. The first cases of the bilious plague have occurred early in summer, usually in July, sometimes in June. These have not excited much alarm, for they have not usually proved infectious; and they have therefore been classed among the ordinary diseases of the hot season. This however has ever been a mistake; they were the less malignant forms of approaching pestilence; yet five or six weeks after their appearance, when the epidemic has showed itself in its formidable array, our citizens have hunted out some vessel from southern climates and palmed the evil on her seamen or cargo.

Van Swieten, Comment. vol. 16, 3. remarks, “that the plague has sometimes lain concealed under the mask of other diseases. When the plague raged at Vienna in 1713, it frequently assumed the appearance of a pleurisy, catarrh, or quinsey, but soon after, broke out buboes and carbuncles, most certain signs of the plague, accompanied with the usual symptoms.”

Here we observe the usual precursors and companions of the plague and the progression of the pestilential principle.

Hippocrates has remarked the augmented violence of diseases, in particular periods. He says, “There are times when almost all the diseases that occur, are extremely malignant, and in general, fatal, so that coughs, phthisis, angina, are all equally mortal. He assures us, that the truth of his observations had been confirmed, in countries very different from each other, and in a variety of seasons and climates.” See the passage cited in Zimmerman on physic, p. 163.

We have multiplied proofs of the justness of these remarks. During the periods which I call *pestilential*, the common diseases of a country, as dysentery, and intermittents, become more obstinate and mortal; and even the pleurisy and peripneumony, acquire unusual violence. And it may not be improper to repeat an observation before made, that the malignant or epidemic pleurisy never appears, except during these pestilential periods.

It precedes or follows, in winter, spring or autumn, those summers alone when pestilence invades our cities. Such was the dreadful disease in America, in 1697-8—in 1761—and which has showed itself, in several towns, during the present pestilential constitution.

But a most satisfactory proof of the progressiveness in a pestilential state of air, and in the corresponding malignity of diseases, is found in the bills of mortality. Thus, before the London plague in 1625, the bill of mortality rose from 8 or 9000, the standard of health, to 11,000 in 1623, and to 12,000 in 1624. The approach of pestilence was clearly announced, two years before it appeared. And as the time of its appearance drew near, the extension or malignity of the preceding fevers was greatly augmented; for in the year of the plague, almost nineteen thousand persons died of other diseases than the plague. As the plague usually prevails from June or July to November, and other diseases are mostly merged in it, almost all the deaths by common diseases must have been in the beginning of the year, from January to June or July. Now, eighteen thousand deaths in the six months preceding the plague, or even two thirds of the number, mark a prodigious increase of mortality—the *common sign of approaching pestilence*.

In the pestilential period in London, from 1634 to 1636, the bill of mortality rose two years previous to the plague.

The last great plague, in 1665, was announced by unusual malignity in diseases, four years before its appearance. In 1661, according to Sydenham, began a series of epidemics, which greatly swelled the list of burials. There was however some abatement in 1663; but in 1664, and the first five months of 1665, the mortality again increased with rapidity, till a dreadful pestilence laid waste the city.

A similar increase of mortality is observable in the bills for Augsburg, previous to the plague in 1628, and in 1635—in Dresden, in 1632 and 3—in Philadelphia in 1793, in New-York in 1795, and in New-London in 1798.

It must however be observed, that the bills of mortality will

not, in all cases, exhibit the augmented number and malignancy of the diseases which precede pestilence; for it sometimes happens that the year next preceding the plague, is very healthy, and the malignancy in the distempers, which mark the beginning of the pestilential state, does not appear till the winter or spring previous to the plague. In this case, the augmented mortality falls within the year and the same bills, as the deaths by the plague. This was the case in Augsburg in the year 1535. In such cases, there is an interval between the preceding epidemics and the plague; such as we have observed in the New-England States, between the influenza and the scarlet fever, and the latter disease and the yellow fever.

Monthly bills will exhibit the progress of pestilential epidemics, with more accuracy.

Fernelius remarks page 161, that "infection is to be perceived in the air, when it produces fevers not pestilent, but which are at the threshold of pestilence,"—plainly intimating that certain malignant diseases precede the plague. He speaks of the fact as general and well understood.

Even in the West-Indies, the infectious yellow fever has its precursors. That fever in Barbadoes, in 1738, was preceded by catarrh and suffocating cough in 1737 and spring of 1738. Yet authors pretend the disease to have been imported from Martinico!

See Warren and Short, vol. 2. 164.

The different modes in which pestilence invades mankind, seem to depend on different causes. Sometimes, the principal cause seems to be an essential alteration in the invisible properties of the elements; in which case, the diseases of a particular constitution, tho somewhat modified in their symptoms, are not controlled or arrested by the seasons. On the contrary the atmosphere continues to be pestilential, and to multiply disorders of a malignant type, through every variety of seasons and of weather. Thus, we observe many instances of violent plagues in the most pleasant, and to all appearance, the most salubrious seasons. Several instances have been mentioned in the preceding history, and we have demonstration of the fact in the United States. The present pestilential state commenced with the measles and

catarrh of 1789 and 90.—The summers of 1794 and of 1797 were apparently temperate and salubrious ; yet in both these summers, the plague renewed its ravages in some towns, tho with less mortality than in the sultry and unhealthy summers of 1793-95 and 98.

On the other hand, pestilence sometimes proceeds principally from excessively intemperate seasons, as in severe heat, after a cold winter. In this case, the pestilence may invade a city very suddenly and without a regular augmentation of mortality from previous diseases. But even in this case, the plague has its precursors, which appear at least a few weeks, if not two or three months previous to its attack.

Thus the plague in Aleppo in 1742, first showed itself in the suburbs in April ; but was preceded by an acute fever in March. The bilious plague in Philadelphia in 1793, according to Dr. Rush, was preceded by the influenza, scarlatina and bilious remittents. The same disease in 1797 appeared, in scattering cases, as early as June.

In New-York, the epidemic of 1795 was preceded by angina trachealis with anomalous symptoms, some cases of obstinate dysentery, at a premature stage of summer, and by febrile complaints accompanied with bilious evacuations. At a meeting of the medical society, early in July, these facts were mentioned, as denoting an uncommon state of air, and the society came to a resolution, to make particular observations on the diseases that might occur, before their next meeting. But, in the interval, the crisis of the pestilence arrived, and removed all doubts.

See Dr. Bailly on the epidemic of 1795, p. 55, and sequel.

The severe pestilence of the year 1798 doubtless owes its violence to a series of most intemperate weather—most excessive heat, following a long and severely cold winter. Yet this disease was preceded by premonitory signs, especially catarrhal fevers. Of all the disorders to which mankind are exposed, none seem to indicate a pestilential state of air, with so much certainty as catarrhal affections. They almost always precede the plague—usually accompany it, and sometimes tread close upon its heels.

In addition to the numerous authorities already cited, in proof



of the progression of pestilence, let me mention Skenkios, who, in speaking of the diseases of 1564 and 5, observes, that anginas, pleurisies and peripneumonies became epidemic; abortions were frequent, pains in the joints, small pox and measles "*quos tanquam præcursores sequebatur epidemica lues, incredibili grafationis sævitia,*" depopulating towns and country, in Turkey, Egypt, France, England and Germany. *Observations*, p. 748.

Skenkios remarked that the plague followed the other epidemics, as its *precursors*.

The same author takes notice of a malignant angina, in 1564, which often proved fatal in a few hours, like the plague. I mention this, because the learned Dr. Fothergill, and tribes of modern physicians who follow a celebrated name, have alledged that the angina maligna is a new disease, not known in Europe till about the year 1610, altho it never was more fatal, than in England in 1517.

In 1573 prevailed dysentery, measles, and purple fever, which in 1574, says Skenkios, *changed into the plague*. His words are remarkable. "*Dudum sane præsagiebat animus mihi, malignum hoc febrium genus, quod toto biennio Europæ partem non minimam peragravit, velut sparfis quibusdam præludiis, in pestem aperitissimam transiturum. Nequè me adeo mea fefellit opinio.*" *Observ.* p. 761. This author foresaw the plague, by means of its precursors.

"*Eodem modo variolæ, morbilli, dysenterix grossantes, sæpissime sunt præcursores internuncii pestis.*" "Epidemic small-pox, measles and dysentery, are very often the forerunners of the plague.

*Hostices*, p. 253.

It is a common remark that the reigning epidemic subdues all other diseases, or compels them to assume its character. This remark, as a general one, is just; and is of no small weight, in proving the connection between certain species of epidemics. In the spring of 1795, the measles prevailed in New-York, but of a mild type. In August, this disease disappeared, being completely merged in the bilious fever that spread from August to November. No sooner had the fever subsided, than the measles



re-appeared, and was of a less favorable type. This is a contagious disease, and yet how impotent was its contagion, in the instance related, under the all-controlling influence of the season and the elements.—It disappeared in summer in defiance of the powers of specific contagion, and was reproduced in autumn, without its assistance.

This fact demonstrates that a general cause operated in the production of that disease ; which general cause, in summer, was controlled, by the heat of the season and local causes in that city ; these temporary and local causes operated during a particular time, and gave a different complexion to diseases ; when they gave way, at the approach of winter, the general cause again assumed its empire and reproduced the measles, which is a disease little affected by local causes.

But while local causes predominated, in producing bilious plague, the general cause was not altogether inefficient ; no bilious pestilence ever becoming epidemic and infectious, but under the influence of a pestilential constitution.

A fact related in Fairfield's diary, relative to the small-pox in Boston in 1702, is very much in point.

This disease appeared in June and gave much alarm ; but proved to be of a mild type, and none died of it for several weeks. It continued to be favorable, till September, when it assumed a more formidable aspect ; being attended with what the writer calls a scarlet fever. The season was excessively dry. In December, the scarlet fever abated, but the small-pox continued to be very mortal, till the following spring. These facts are related by an unlettered, observing man ; but they are evidence of a progressiveness in the disease. The efflorescence that accompanied the disease from September to December was only a particular, malignant symptom or modification of the small-pox, produced by season or other temporary cause.

The measles often exhibits a similar progression. This circumstance explains the difficulties mentioned by medical writers. Dr. Rush mentions the circumstance of persons in 1789, who had a fever, cough and all the symptoms of measles, except a general eruption. Some had a trifling efflorescence about the

neck and breast. The same happened in 1773 and 1783. Vol. 2. 238. The fact is also mentioned in *Edinburgh Medical Essays*, vol. 5. Persons thus affected have the measles, months or years afterwards. This lighter species of the measles is produced by the same general cause which produces the disease in full force; but the constitution, at that time, resists the further operation of the cause. At a future time the cause will produce the disease complete.

Under the history of the diseases of 1792 and 3, I have related the progress of the late scarlatina in this country. There cannot be stronger evidence of the progression of an epidemic influence in the atmosphere than the history of that distemper has furnished. The violent stage of that disease, was preceded four, five, and in some places eight months, by a milder species of the disorder; and this mild form was, in some places, an epidemic. These facts entirely overwhelm all the pretended influence of infection, in originating the disease. They prove incontestibly that a state of air suited to the production of that disease, was not the effect of any sudden, visible change in the seasons; for the mild form of the scarlatina appeared indifferently, in any season of the year; as at New-York in August, at Hartford in May and at New-Haven in November; but that it was a progressive change, gradually inducing debility in the human body, or whatever else may be its predisposition to a particular disease.

Whether the scarlatina appeared, in any part of the country, without being announced by this slight form of the disease, is a question that cannot be solved, without particular information from every town. And very possibly the fact itself may have passed, in some places, unobserved. But the progressiveness of the distemper was distinctly marked in New-York, in Fairfield, in New-Haven, in Bethlem and in Hartford.

The same phenomenon was observed in the same disease, in 1786, in London. The first case appeared in March, was of a mild kind and excited no great apprehension. No other case occurred to the knowledge of the physician, except in the same family, till May, when another case appeared, but of a light kind. In June, the disease became epidemic and malignant.

Here we observe the progress of the pestilential principle, in England, like that which has been observed in America.

See Memoirs of the Medical Society, London, vol. 1. 388.

A remarkable fact mentioned by the great Mr. Boyle, in the fifth volume of his works, p. 724, serves to show the regular progression of that state of air which produces the plague. In 1665, three months before the plague broke out in London, a man sent for a physician, complaining of a swelling in his groin, from which circumstance he predicted the plague which was to follow, and said he had experienced the same swelling in the former plagues, which he considered as the certain forerunner of the disease. Boyle took this account from the physician himself.

This was no whim, for it is perfectly philosophical. It is a common fact, that, during the plague, in a city, persons in health experience severe pains in the glands, as in the groin and under the arms, those sensible parts which are peculiarly affected by the disease. Sorbait mentions that he felt such pains, during the plague in Vienna in 1679, and others did the same, but without any tumor. Dr. Gothwald experienced similar pains in the plague at Dantzick in 1709.

See Baddam's Memoirs, vol. 6. 12.

Boyle, vol. 6. 429, relates that one Beale knew a woman who could certainly tell when the plague was in the neighboring country, by a pain in the wounds of three sores she had, when affected by the plague in her youth. The relation is altogether credible; for we know that the state of air producing the disease, occasions pains in the glands of persons in health; much more therefore would the same parts, after being rendered more sensible by plague sores, be affected with pain, during a similar state of air. The facts demonstrate that the plague is produced by a peculiar state of air, which may be perceived before the disease appears; and much more, during its prevalence, by persons in health.

Another fact demonstrative of the same doctrine of a progression in the pestilential principle, is, the unusual number of abortions, which precede the invasion of a severe plague. This fact was observed by Diemerbroeck, previous to the plague in Ni-

mueguen, in 1636, and is numbered by him among the presages of the disease. De peste page 11. Other authors have recorded the same fact, among whom Diemerbroeck cites Alexander Benedictus, Forestus and Seunertus.

The cause assigned for this phenomenon, is, "the debility of the heart and other viscera, which renders the tender body of the foetus incapable of resisting the malignity of the pestilential poison, and which exposes the woman in a pregnant state, to continual irritation."

In confirmation of this principle, we may cite the facts, so frequently mentioned by writers on this subject, that the plague rarely or never spares pregnant women. This was remarked by Livy and Dionysius in Rome—by Procopius and Evagrius, in the plagues of 543 and 590, and by subsequent writers.

The fact authorizes the supposition, that a pestilential state of air induces extreme excitement or irritability, and consequently indirect debility, especially in the nervous and vascular systems. The effect of this general cause must of course be first visible in persons most susceptible of excitement—among whom are pregnant women, which is obvious from the facility with which they receive impressions from the sight of unnatural objects. The appearance of the effect of the pestilential state of the atmosphere, on such persons, *previous to its fatal effects on other persons*, leaves no room to question its gradual increase in strength.

Of the progressiveness of pestilential epidemics therefore we can have no doubt, nor of their connection through a common cause. The order in which they show themselves is not exactly the same; being varied by a multitude of subordinate causes, as seasons, weather, noxious exhalations, and sometimes perhaps by infection.

The accounts of diseases in the two or three last centuries are recorded with so little regard to just arrangement, that it is not easy to collect from them the exact order in time, in which the epidemics of any particular period have appeared. Sydenham however has left an admirable sample of the history of epidemics in London from 1661 to 1680—a sample that throws immense light on the principles here maintained—a sample which

ought to be well studied, and which it is inexcusable in medical writers not to imitate. Let any man observe the regularity with which certain eruptive diseases, as the measles and small-pox, appeared and subsided, according to the seasons, during the constitution of air fitted to produce them, until both yielded to a different constitution, and then say, whether he can question Sydenham's principles, or the existence of a general contagion, operating in the production of a particular class of diseases. Under a philosophical view of such facts, into what trifles will dwindle all the formidable vulgar doctrines about infection!

It must however be remarked, that the small-pox, in modern times, will not exhibit similar effects as formerly; since the art of inoculation has nearly banished the disease as an epidemic; from our cities, where alone it used to prevail to any considerable extent.

Let us then attend to the order of the epidemics which have marked the latest periods of pestilence in America; many of which are within the memory of the present generation.

A. D.

1733 influenza.

1734 unknown.

1735 } angina maligna.

1736 }

1737 severe influenza.

1738 } pestilence in Barbadoes, Charleston and Mexico,

1739 } measles New-England.

1740 measles America.

1741 angina, pestilence Philadelphia and Virginia.

1742 anginas.

1743 pestilence in New-York.

1745 dysentery, pestilence New-York and Charleston.

1746 pestilence at Albany and among the Mohegans.

1747 influenza.

1748 }

1749 }

1750 }

1751 }

1752 }

1753 }

measles, dysentery and angina.



- 1754 } angina.  
 1755 }  
 1756 dysentery in some places.  
 1757 influenza.  
 1758 measles.  
 1759 measles, dysentery, fevers.  
 1760 unknown, till autumn, then  
 1761 influenza and inflammatory fevers very fatal.  
 1762 pestilence in Philadelphia.  
 1763 pestilence among the Indians on Nantucket.  
 1764  
 1765 } dysentery.  
 1766 }  
 1767 } unknown.  
 1768 }  
 1769 measles, angina.  
 1770 angina, fevers.  
 1771 catarrh, angina.  
 1772 influenza and measles, angina.  
 1773 angina, dysentery.  
 1774 angina, dysentery.  
 1775 }  
 1776 } angina and dysentery very fatal.  
 1777 }  
 1778 fevers, but no epidemic.  
 1779 health.  
 1780 health.  
 1781 influenza.  
 1782 influenza Europe.  
 1783 measles, angina.  
 1784 }  
 1785 } anginas and bilious fevers.  
 1786 }  
 1787 }  
 1788 measles began in autumn.  
 1789 measles, influenza.  
 1790 measles, influenza.

1791 pestilence began in New-York, but not severe.

1792 angina began in New-York.

1793 angina, plague, dysentery.

1794 angina, plague, dysentery.

1795 angina, plague, dysentery, measles.

1796 angina, plague, dysentery, measles.

1797 plague, dysentery.

1798 plague, dysentery, typhus mitior.

1799 plague.

Such has been the general course of epidemic diseases in America, as far as I can obtain information. Further enquiries may render the account more accurate, and more nearly perfect.

It will be observed that the order is not quite uniform ; nor is this to be expected, considering the various causes which concur in the production, and diversification of diseases. In general, measles and catarrh precede anginas, dysentery and pestilential fevers. And it is remarkable that these diseases belong to the class of inflammatory diathesis : So does the mild small-pox, which, before the practice of inoculation, was almost regularly a precursor of the plague in the cities of Europe.

In general then epidemic diseases first attack the brain and the throat, before they seize the whole nervous system and the abdominal viscera. It is observable also, that winter, spring and autumn, produce mostly diseases of the stenic diathesis, as measles, catarrh, and inflammatory fevers ; and summer, diseases of astenic diathesis, as typhus fevers, dysentery of a malignant kind, and plague. Indeed the plague seems to begin and end in catarrh—that is, it begins in catarrh in winter and spring, takes the form of plague, during the hot season, and re-assumes the catarrhal and inflammatory form in the succeeding winter. The measles and influenza, however, prevail at any season.

When I arrange epidemics under particular years, I speak of those diseases which extend over a whole country, or occur in many places. If we look into large cities, we shall find some of these diseases, almost every year. But my observations relate only to those diseases when they become general, or occur in various parts of a country in the same year.

When I place angina, plague and dysentery against a particular year, it is not intended that these diseases were all epidemic in the same place. Thus, while in 1793 the plague was in Philadelphia, the scarlatina began to prevail in New-York and the western part of Connecticut. For it must not be overlooked, that although measles and influenza appear nearly at the same time in all parts of the United States, yet the pestilential fevers that follow them first show themselves in the larger cities in the southern latitudes. Thus the measles and influenza were universal in 1789 and 90, at least this was the case with the influenza; but the bilious plague broke out in New-York, Philadelphia and Charleston, before it did in Boston and Newburyport. The same is observable in the other hemisphere. The influenza spreads over Asia, Europe and Africa, in a few weeks, but the following pestilence first appears in Egypt or the Levant, or in Turkey, then in the northern parts of Europe. To these remarks there are few exceptions.

It is also observable, that the pestilence in cities takes the form of petechial fever and plague; but in country towns, more generally terminates in dysentery.

It is a popular opinion that measles and small-pox never originate in the human constitution, without contagion. The palpable absurdity of such an opinion has not prevented its propagation and belief, among even well-informed men. So far is this opinion from truth, that the first cases of these diseases in every epidemic period, are always generated in the human body, without contagion. When the condition of the elements is fitted to produce these diseases, they appear in all parts of a country, without contagion, they spread rapidly, and decline when the general causes cease to operate. During this period, contagion is efficacious in propagating them, and no longer. When the condition of the elements is not fitted to produce them, if sporadic cases appear in particular habits of body, they will not always spread the diseases.\* Sydenham long ago taught this truth, in describing the changes

\* This is here meant of the natural contagion of the diseases from the breath and effluvia, which is not always efficacious in spreading them. The variolous matter of small-pox is excepted; for, if good, this will generally communicate the disease at any time.

in the epidemics of 1670—1672. Measles and small-pox came and went with the seasons and condition of the air.

The truth is, that certain conditions of the elements tend to produce *eruptive diseases*, and before the practice of inoculation, the small-pox was almost regularly one of that series of epidemics which I class together, as of one family, and the precursors of plague. It is nearly allied to the measles, and appears usually about the same time. I am convinced that catarrh, measles, mild small-pox and whooping cough, are but varied forms of disease, occasioned by modifications of the same elemental causes.

Certain it is, they are all predominant about the same time, and as a general remark, they *precede* the invasion of diseases which bear the character of *typhus*.

I have never conversed with a physician who could not name instances of small-pox, originating without any known contagion, and generally medical gentlemen admit the disease to be generated in the constitution. This principle is unquestionably just, and ought to be known, and received as truth; for the belief that contagion is necessary to the existence of the disease, has produced most mischievous consequences. An instance happened in Sharon a few years ago, in which a woman was seized with the small-pox; but as she had not been exposed to contagion, her disease was mistaken, till just before her death; and twenty or thirty persons were supposed to have taken the disease before the true nature of it was understood.

In the winter of 1797-8, occurred in Hartford two sporadic cases of measles, which could not possibly be traced to contagion. At another time, a family was infected by means of a stranger; but in neither of these cases was the disease propagated to others, who were exposed to the breath of the patients. See Dr. Cogswell's letter, Med. Repos. vol. 2. 301. Innumerable similar instances may be mentioned.

In the same manner the various species of angina and the plague occur in sporadic cases under the operation of powerful local and constitutional causes, which, if not favored by the condition of the elements, will not spread and become epidemic.

## SECTION XIV.

*Of the extent of a pestilential state of air.*

FROM a view of the facts related in the preceding history, it appears that epidemics, agreeable to the definition already given, are of two kinds—first, those which are limited to a particular town, city or country ; secondly, those which pervade whole quarters of the earth, or the whole globe. The first may be called local, the last, general or universal epidemics.

The local epidemics, most usual, are dysentery, remitting and intermitting fevers, and pestilence. The epidemic, most frequently universal, is the catarrh or influenza. Angina is often a general epidemic, sometimes local. Pestilential fevers, in certain periods become general over vast tracts of the earth. The same is observable of the measles.

The epidemic catarrh is the disorder which most decisively proves a rapid and universal change in the essential properties of the atmosphere. This disease sometimes invades the human race so suddenly, that half the inhabitants of a town or city are seized in a night. I do not find the same fact related of any other disease, except the sweating plague in 1529, whose progress through Europe was as rapid nearly as that of the catarrh, and utterly precludes the supposition that infection from fomes, had any share in its propagation.

Catarrh however is not always a universal epidemic. In many instances, it is confined to one hemisphere, as in 1647, 1655, to America ; and in 1650, 1775, to Europe.

In other instances, this disease spreads over the whole world, in a short period, but is progressive, appearing in the two hemispheres, in two different years. Thus in 1761, it was epidemic in America ; in 1762 in Europe.—In 1781 in America ; in



1782 in Europe; in 1698 in America; in 1699 in Europe. In two or three instances, I find it in both hemispheres in the same year.

The compilers of the Encyclopedia say that catarrh from contagion has "seldom appeared in any one country in Europe, without appearing successively in almost every different part of it; and in some instances, it has been also *transferred* to America, and has been *spread* there, so far as we have had opportunities of being informed."

See article, Medicine, No. 253, from Cullen.

No source of errors, in the science of medicine, is more fruitful than the doctrine of contagion. It would seem from the passage recited, that the writer considered catarrh as propagated by fomites from diseased persons; and conveyed across the ocean by the sick, or in goods or cloathing. The words will admit of no other interpretation; and yet it is hardly credible that, in this period of science and observation, an obvious and common phenomenon should be so egregiously misunderstood.

The catarrh, whenever it has appeared as a general epidemic, instead of being *transferred* to America, has usually appeared in America *before* it has in Europe or at the same time; and so far is contagion from being the necessary cause of its origin and propagation, that the disease invades seamen on the ocean in the same hemisphere, when a hundred leagues from land, at the same time that it invades people on shore. Of this I have certain evidence from the testimony of American Captains of vessels, who have been on their passage from the continent to the West-India Islands, during the prevalence of this disease.

If further evidence is required, we have the fact, that the epidemic catarrh in America rages with as much violence in the islands as on the continent, and at the same time. And in the preceding history, it is stated on the authority of a medical publication in Scotland, that the universal catarrh of 1733, appeared in the Isle of Bourbon, in the Indian Ocean, about the time it did in Europe.

From these facts, it is evident that the disease is occasioned by an alteration in the atmosphere. In many instances it is limited to one hemisphere; but it is observable, that whenever it appears

on the American continent, it appears also in the islands of the West-Indies. Its range is through a certain section of the globe, nearly in the same longitude, north and south, on one of the great divisions of the earth, and in the vicinity of the continent. The epidemic catarrh of America extends certainly from the northern limits of the United States to the island of Barbadoes. Whether it appears at the same time in South-America, I cannot find a hint in any author to guide my opinion, except in regard to the last epidemic, which pervaded that part of the continent.

The catarrh of 1733 extended over the globe, but it appeared first in America. Possibly there may have been other instances, since the settlement of America, but I have little information on this point, in regard to this country. It is not probable, for instance, that the severe catarrh of 1708-9, was confined to Europe, but it is useless to indulge conjecture.

The remote cause usually assigned for catarrh is a sudden change of weather, from heat to cold or from cold to heat—the proximate cause, an increased afflux of fluids to the mucous membrane of the nose, fauces and bronchiæ, with some degree of inflammation. Some medical writers seem to think the remote cause to be the application of cold only to the human body, checking the perspiration by the skin, and turning the fluids upon the mucous membrane. See Cullen on this point.

The proximate causes of the disease are the province of medical men; but to the influence of the remote cause above stated, physicians will pardon me for stating a few objections.

1. The application of cold to the body cannot be the sole cause of catarrh, because it appears, and usually with most severity, in the spring, on the abstraction of cold. It is observable also, that in many instances its principal violence and mortality, are, after the return of warm weather—the disease augmenting in violence with the increase of heat. Thus the catarrh of 1709 appeared in Italy, says Lancisius, in January in severe cold weather, but increased in violence, as the spring advanced and the weather moderated.

The same fact took place in the catarrh of 1762 at Edinburgh, where it began in April and increased in violence till June.

In the same manner, the catarrh in this country in 1790, appearing in March and April, on the moderation of cold, was far

more severe than that of the preceding autumn, when the weather was changing from heat to cold. At least this was the fact in many of the northern states.

2. It is not always true, that the epidemic catarrh appears in spring or autumn, or after great changes of weather. The noted catarrh of 1580 began to appear in Sicily in the month of June; at Rome in July; at Venice and Constantinople in August—in the midst of summer. It is against all probability, that this disease can be ascribed to the application of cold. On the other hand, its progress was evidently steady, and uninterrupted by either heat or cold—A careful attention to the history of this epidemic at other times, will doubtless furnish other similar facts.

The catarrh of 1688 seized Germany in summer; that of 1557 appeared in Spain in August; that in America in 1655 began about the close of June.

3. The appearance of catarrh in tropical climates, as in the West-Indies, at the same time it appears in northern latitudes, is a strong argument against ascribing it to the application of cold. In the West-Indies there is no change of any great consequence, in the temperature of the weather; nothing like *cold* is known in those regions. Yet catarrh, if credible accounts are to be admitted as evidence, is as fatal at times within the tropics, as in any other climate.

It is true, that in autumn winds called *norths*, northerly breezes, are experienced in the islands, and these produce colds and coughs similar to what we all experience, in temperate latitudes, on the change of weather in spring and autumn. But these are very different, at least in degree, from a general epidemic influenza, which seizes mankind in all climates, with pain in the side and bones, accompanied often with fever. The universality of this disease, bursting suddenly upon all climates, and raging with equal violence in all seasons, and in defiance of heat or cold, leave us no room to question its dependence on some other cause than changes of weather or application of cold.

4. If the application of cold was the sole cause of this epidemic, it would appear at the same time in all places which experience a sudden change from heat to cold at the same time. And fur-

ther, a necessary consequence would be, it must be epidemic on every such change. Neither of these cases occurs. On the other hand, the disease begins indifferently in any climate and in any season of the year, and spreads speedily over whole countries, without the least obstruction from heat or cold : And as far as I can observe from the accounts of it before me, it is as mortal when it invades people in hot climates, as in cold or temperate regions and seasons. It is also progressive in point of place ; but it moves with a celerity unknown to all other diseases. Sometimes it passes over Europe in six weeks. In America, its duration in 1789 and in 1790, was nearly the same. Different epidemics, however, differ in the rapidity of their movements : That of 1589 was about six months in traversing Europe.

Different epidemics also differ in point of generality and violence. Sometimes the catarrh is a light complaint ; at other times it is attended with fever, and occasions no inconsiderable mortality. The catarrh in the spring of 1790, was much more severe than that of the autumn preceding. In 1789, it resembled a severe and universal cold—in 1790, it bordered more on the pleurisy and peripneumony. To these remarks there may have been particular exceptions.

5. It appears to me also, that, with deference to the faculty, a strong argument against deriving the disease from sudden changes of weather only, may be drawn from a difference in the symptoms of an epidemic influenza and of sporadic cases of the disease, obviously contracted by cold. Let me ask practitioners, whether in the epidemic catarrh, there do not appear symptoms altogether unknown in sporadic cases ? But as this is a point that regards practice, it is not proper for me to discuss it.

The celebrated Boyle very justly observes that sudden epidemic colds, are not to be accounted for by changes of weather. Vol. 5, p. 49.

I do not, however, deny the influence of heat and cold in the epidemic catarrh. In some violent epidemics of this sort, heat and cold seem to have little influence—the disease appearing to rage, independent of all the sensible qualities of the air. Yet in ordinary cases, the temperature of the air seems to *modify*, but not to *generate* or *destroy* the epidemic.



Brown, in his elements of medicin, arranges catarrh among diseases of the stenic diathesis. Whether he meant to extend his observation to sporadic cases from cold only, or to the influenza also, I do not know; but it may not be improper in me to mention, that in many epidemics of this sort, bleeding has proved injurious or fatal. The most generally successful remedies have been the diaphoretic, although there have been a few exceptions, in which bleeding was salutary. Indeed no disease seems to admit of a greater diversity of symptoms.

Next to the catarrh, in the list of general epidemics, we may perhaps arrange the measles, which, though sometimes a local disease, often appears over whole countries, and sometimes in both hemispheres at the same time.

This disease is attended with specific contagion, which aids its communication from place to place; but it derives its origin from a particular state of the atmosphere. Hence it appears in one season and disappears in another, yielding to some other disease, as Sydenham remarked in the year 1672, and which we observed in New-York in 1795. It is nearly allied to the catarrh as is evident from the catarrhus symptoms that attend it. Brown classes the measles in the number of stenic diseases.

It will be found on examining the history of diseases, that the measles usually *precedes* or *follows* an epidemic influenza. The two diseases therefore manifest a close alliance in the remote causes.

My accounts of epidemics are too imperfect to authorize the assertion, that these diseases *always* appear nearly together; but this has been the fact, with respect to a number of the last epidemic periods in America. The order however is varied. Sometimes also a slight degree of one or both of these diseases is experienced in particular places, when neither of them is epidemic. But when they become violent and general, they are nearly contemporaneous, spreading successively over a large portion of the earth, and sometimes over both hemispheres.

In 1772 the catarrh and measles raged in the same year, from Boston to Charleston. To these succeeded anginas and dysentery, for a series of years. In 1781 and 2 catarrh pervaded the



globe. In 1783 began measles in May, and angina in August. In 1789 measles preceded the influenza. In 1757 influenza preceded the measles.

An epidemic which used formerly to make a figure in medical history, as one nearly cotemporary with measles, was the small-pox. The disease was observed by Sydenham, to rage alternately with measles in different seasons of the year. Like the measles, it is an eruptive disease, of the stenic species specifically contagious, and evidently depending on the same general cause, though on different temporary or local causes. Inoculation has nearly banished this from the list of epidemics.\*

But a more formidable epidemic, and perhaps the most formidable to which the human race is exposed, is the angina, using this word to denote all the different kinds of affections of the throat. I call it the most formidable, because hitherto no means have been discovered of arresting its progress. Its horrors and fatality are not mitigated by inoculation, like those of the small-pox; nor are its usual ravages limited to populous towns, like those of the plague. Under all aspects, therefore, I consider it as a far more dreadful disease than either, because the others may be mitigated or avoided.

Affections of the throat, either in the form of scarlatina anginosa, angina maligna, cynanche trachealis, &c. are among the epidemics which belong to almost every pestilential period. In the order of appearance they have not one uniform place; but in America, anginas have usually succeeded catarrh, the first or second year, and continued to the fourth or fifth. In the three last epidemic periods, this order has been very uniform. I speak of epidemic angina which spreads over the whole country; for in particular places we hear of it almost every year.

These diseases in our large cities have been succeeded by the

\* It is a common error that this disease never originates without contagion. Before the art of inoculation, it was an epidemic in large cities, appearing and disappearing with as much regularity and certainty as the measles. I can name many instances of its originating in this country without contagion or infection, and I have the authority of many old practitioners of medicine for the fact. It most usually appears in those years which manifest a disposition to produce other eruptive diseases.

bilious plague, and in the country, by violent remittents, typhus fevers and dysentery.

Sometimes angina prevails without being followed by the plague: That is, the constitution of air terminates at that point of its pestilential progress. Such seems to have been the fact with the angina of 1755. And in all cases in which it is of a mild kind, or not universal, strong hopes may be entertained, that no plague will follow it. The epidemic anginas from 1783 to 1786, were of this kind.

With respect to the universality of the cause of these epidemics, it is to be observed, that it is of two kinds—sometimes it extends to both hemispheres, at other times it seems to be limited to one. Those diseases, however, which are least influenced by heat or cold, or which depend most on some invisible state of the atmosphere, appear most frequently in both hemispheres, at the same time. This fact, with respect to the catarrh, has been particularly noticed.

The same fact is observable very often with respect to the measles, and especially with regard to anginas. These affections of the throat, when violent, are nearly cotemporary in Europe and America. Witness the periods from 1751 to 1756—from 1773 to 1776—1783 to 1786—from 1793 to 1796, and in 1742.

This cotemporaneity of certain epidemic diseases, in both hemispheres, is an important fact which has hitherto been little noticed, but which opens a new field for philosophical investigation. It demonstrates that such diseases are occasioned solely by a constitution of air, without the influence of contagion, although when the diseases are formed, they are contagious.

But we have further facts of a similar nature. It is observable that the pestilential principle often extends from Egypt, Syria and Turkey, over all Europe and to America. But the same diseases, that is, the same forms of the pestilence, do not always appear in Egypt or Turkey, and in France, England and America, in the same year. It is a general fact, that the worst form of pestilence, the inguinal plague, appears first in Cairo, Smyrna or Constantinople; and from this circumstance, the advocates for the propagation of that disease by specific contagion, have drawn their most

powerful arguments in support of their theory. But this argument is founded on a view of the subject, most miserably narrow and obscure.

In every pestilential period, there is a series of epidemic diseases. The order in which they appear depends on local or temporary circumstances. Thus in Grand Cairo or Constantinople, the climate or the strong local causes, speedily bring the pestilential principle to its crisis, in the production of the plague. For this reason, that disease appears in those cities, some time *before* it does in northern latitudes or in more healthy cities.

But at the very time the plague appears in Constantinople or Cairo, some lighter epidemic disease, belonging to the series, appears in other parts of the world, indicating the approach of pestilence. Thus, in 1580 and 81, Cairo was desolated by a hideous plague; but, at the same time, a severe epidemic catarrh burst forth on all Europe, the certain forerunner of pestilential fevers, and which, in that instance, was succeeded by plague in 1582 and 3, as far north as England. Let facts within late periods, decide this question.

The plague appeared in the Turkish dominions in 1718; but in 1719 became more general. In 1718 the bills of mortality were considerably swelled in Amsterdam, London and Vienna, but in 1719 they rose, in the two former cities, considerably higher—the pestilential state of air pervading the most of Europe. I have no account of the state of diseases in Marseilles, in 1718; but in 1719 appeared a pestilential fever, which increased the mortality, altho the pestilential principle did not rise to its height till the subsequent year.

In this period, cotemporary with the plague in the Levant, was a universal increase of mortality in Europe, and the same state of air was experienced in America, altho, in very few parts of Europe, did the pestilential principle arise to the degree of plague.

In 1726 we again hear of the plague in Egypt, and for two or three years succeeding, the bills of mortality were swelled in Europe and America. Of the epidemics that prevailed in America, I regret my want of information.—I only know that measles and malignant pleurisy prevailed in this country.

In 1735 and 6 raged the most desolating fore throat in America, and at the same time, the most fatal plague in Egypt, that has appeared in this century. This pestilence, like that in the time of Thucydides, took its rise in the interior parts of Egypt or Ethiopia. And it must not be overlooked that the violence of the pestilence in Egypt corresponded with that of the fore throat in America—a fact which, as far as I can discover, is generally true, that the more fatal the epidemics that prevail over one quarter of the globe, the more violent are the same or other pestilential diseases, in the other hemisphere. It makes little difference, that in one country rages the glandular plague, and in another the petechial fever or putrid fore throat—These are only different forms of pestilence, the *effects of one common cause, modified by local causes*. The great point is, that such epidemics are *cotemporary in countries the most remote*. Slight epidemics may appear alone, but never the more severe and deadly forms of pestilence; excepting perhaps dysentery, or some other complaints that depend mostly on the seasons.

The years 1740-41 and 42 were also pestilential. At what time the plague of this period first appeared in the east, I am not informed. But it raged in Syria from 1742 to 1744, and it rarely happens, that it is not a year or two earlier in Egypt or Constantinople, than in Syria. Cotemporary with the plague of this period was great mortality in London and Amsterdam from the petechial fever, which fell but little short of the plague. See the bills.

At the same time, raged in America a series of epidemics, particularly measles, anginas and the bilious plague; the latter appearing in Philadelphia and Virginia in 1741, and in N. York in 1743, the same year with the dreadful pestilence in Messina.

The year 1755, the year of a great plague in Constantinople, was distinguished for catarrh in Europe, and fore throat both in Europe and America.

In 1758 commenced the pestilential period, which was universal and felt in both hemispheres, in some one or all of the years from 1758 to 1763. Here, it is observable, our information is more correct. In 1758, cotemporary with the beginning of this



pestilence, was an epidemic catarrh in Europe. Then followed other epidemics of a more malignant type. During this pestilential period appeared in America, the catarrh and measles, and the plague in Philadelphia in 1762; but especially the fatal epidemic pleurisy in 1761.

The next period commenced in 1769 or 1770, in which the plague spread over the east. This period was begun by measles and anginas, if my information is correct, in 1769—catarrh was epidemic in 1771 and 2, and in the latter year measles of a bad type. Then followed angina, and the epidemics all closed in dysenteries. The plague in the Levant was cotemporary with the commencement of this period.

I am not informed of the precise time when the plague of the next period commenced in the Levant, but it was raging in 1783 and 4, during the prevalence of measles and angina in America.

In the last period, the plague in Egypt was very violent, about the time the mortality commenced in America. Of the precise time when it began in Egypt I am not informed; but it prevailed in 1791, the year it appeared in New-York and Grenada, and was most destructive the following year, 1792, the year when the scarlatina first appeared in the northern parts of America.

I have no further accounts of the plague in Egypt, but the public prints have informed us, the disease prevailed in Constantinople in 1797, and was more general in the Turkish dominions in 1798, the most fatal year in America.

The reader will be pleased to remark, that when I speak of the plague in Grand Cairo or Constantinople, I refer only to violent and destructive epidemics. The plague, in a light form, and in a few cases, occurs almost annually in those great cities, where the common causes and ordinary seasons are adequate to its production in particular constitutions. But, let me observe, that no extensive and desolating plague ever ravages either of those cities, except under the influence of general contagion, or an epidemic state of air, which is experienced, nearly at the same time, in Europe and America.

These facts enable us to solve the whole difficulty which has puzzled physicians, in regard to the different kinds of yellow



fever, which appear, at different periods, in the West-Indies. The simple truth, is, that in ordinary seasons, when no pestilential constitution of air exists, the fever of the West-Indies, is not contagious. It attacks strangers with violence and destroys life, but is not communicable *per se*. Hence the authors who have written on the subject are correct, in asserting this ordinary fever, not to be contagious.

But after catarrh has pervaded the hemisphere, and during the increase of mortality in the Levant, in Europe and on the American continent; that is, during a pestilential state of air, the fever of the West-Indies assumes double malignity, and becomes contagious. In years of health, the disease rarely attacks natives of the islands; but in unhealthy periods, not only native whites, but even blacks are sometimes affected with the disease. Among these however it is less destructive.

Thus we solve the problem which has embarrassed all the medical writers on the yellow fever, the most able of whom have been compelled to declare that the fever in the Islands is sometimes contagious, and at other times, not.

This view of the subject would have prevented the trouble of authors who have labored to prove the disease imported from Siam, or the African coast.—Dr. Chisholm, instead of attempting to trace the Grenada fever of 1793 to Africa, through the ship Hankey, had only to remark, the prevalence of the catarrh in 1790, of the plague in Egypt in 1791, and of the scarlatina in the United States in 1793, and he would have seen the beginning of a most extensive and malignant series of diseases. The truth is, the pestilential state of air first manifested itself in Grenada in 1791, [the year it commenced in New-York] by new and singular symptoms, which surprised Dr. Chisholm. And this, by the way, was before the beginning of the present war, on the part of Great-Britain, and of course, it could not be ascribed to that circumstance. The same fact, when justly considered, is demonstration, that the disease was not brought from Africa.

It must be remarked however, that the fever of the tropical

climates, though not contagious in sporadic cases, in healthful years, may at any time become epidemic and contagious, under certain circumstances. Thus large bodies of soldiers and seamen, passing suddenly from high northern latitudes into the West-Indies, may contract the disease, and render it so virulent by crowded camps and ships, as to render it very infectious. This is usually the case in wars between England and France, which call great numbers of men from Great-Britain into the islands.

Yet even in this case, the mortality of the disease is increased by a pestilential state of air, concurring with such local causes. Such was the state of air from 1760 to 1763, during which the British and American troops perished before Havanna. Such also has been the state of air for eight years past, in which the destruction of the British troops in the islands has been unparalleled.

This circumstance has led a respectable college of physicians in Philadelphia, to insinuate that war is a cause of the disease. Their words are, "it exists in the West-Indies, particularly in time of war, when great numbers of strangers are to be found there, and reference to dates will show, that in *most* of the instances of the occurrence of the disease in the United States, there has been war in the West-Indies." Memorial to the Legislature of Pennsylvania, Dec. 5, 1797.

This assertion, however, is not authorized by facts. The deplorable plague in Philadelphia and Charleston in 1699, was in time of peace. That in New-York in 1702 was in the first year of a war, but could not have been derived from that circumstance, in so short a time.

The same disease at Barbadoes and Martinico, in 1723, was in time of peace, in Charleston in 1728, in time of peace—at Carthagena the next year, in time of peace—at Charleston and New-York in 1732, in time of peace—at Barbadoes in 1738 and 1764, in time of peace. The instances which happened between 1740 and 48, were in time of war, as was that in Philadelphia in 1762. The present war has exhibited melancholy effects of diseases in the West-Indies; but it is an indubitable fact that the plague of the present period commenced in 1791, a year before the war, and before numerous reinforcements of troops had been

sent to the islands. It must further be observed, that during the eight years war between America and Great-Britain, no yellow fever appeared in the United States ! a striking fact.

It is certainly a most unfortunate circumstance for the credit of the college of physicians, that the longest interval of peace during the present century, from the treaty of Utrecht in 1713, to the Spanish war of 1740, includes in it the longest and most severe state of pestilential diseases, in Europe, Africa, America and the Islands, that has occurred, during the century. A simple inspection of the bills of mortality, during that period, will demonstrate the fact !

One thing, however, may be asserted with truth, that whatever may be the extent and violence of the bilious plague in the West-Indies, it never has appeared in the northern parts of the United States, except in periods when a pestilential or sickly state of the air is manifested by the prevalence of other epidemics. In tropical climates and in the southern parts of America, particular circumstances, as great bodies of fresh troops from northern latitudes, or unfavorable seasons, may generate the disease in any year, however healthy in temperate latitudes. But from Maryland northward, this American plague has never appeared without being preceded by other epidemics. Let facts be resorted to for confirmation.

We read of malignant diseases in America, anterior to the year 1699, but the order of them is not described. The fatal plague of that year was preceded by epidemic catarrh, and the plague raged, at the same time, in the Levant. The same disease in New-York in 1702, belongs to the same period, which seems to have commenced in 1697 and ended in 1702.

The next sickly period was from 1709 to 1713, beginning in Europe with the severe catarrh of 1709, which was followed by plague in the Baltic towns, in Hungary, Vienna, &c. accompanied with a most desolating sickness among horned cattle and horses, in Germany and Italy. Of the effects of this constitution of air, in America, I have but two instances, which were a most distressing sickness in Waterbury, in Connecticut, which almost depopulated the town, and epidemic measles in 1712.

Of the next pestilential period, about 1720, I have also but two instances in America; the mortality at Duck creek, as already related, and the malignant pleurisy in Hartford.

The plague in Philadelphia and Virginia in 1741, and in New-York in 1743, was preceded by the usual epidemics, influenza, measles, angina, &c. and at the same time the plague was raging in the Levant and in Sicily.

The same disease in Philadelphia in 1762 had its usual precursors, measles and catarrh, and this occurred during the prevalence of the plague, in the Levant.

I hardly need to mention, in proof, the present epidemics. It is well known, we have passed through the whole series of precursors, catarrh, scarlatina, measles, &c. the two former being far more general and severe than usual; indicated, with infallible certainty, the violence and extent of the plague which was to follow.

From a long series of facts, then, we demonstrate that the plague of our climate depends on some *general cause*. And it must abash and confound the sticklers for the propagation of this disease from country to country by fomes, to know that the disease never occurs in the temperate latitudes of America, except under a pestilential constitution of air, manifested by other malignant diseases in this country, which are certainly *not* imported, and during also the prevalence of similar diseases in the Levant, and an increase of mortality in other countries. It must still more confound these persons, if they have any susceptibility of conviction, to observe that these very pestilential diseases, instead of being conveyed from place to place, appear at one and the same time in Egypt, Turkey, the West-Indies, and in the United States. This is very common, and probably is always the fact.

If the pestilence were introduced into this country, from the islands, and if the disease is capable of being propagated as an epidemic, from fomes, why, let me ask, has it never been propagated in the United States, in healthy periods? It has been *imported* probably in hundreds of instances, from the islands, ever since the commencement of the West-India trade.

Not a year passed from 1763 to 1791, in which multitudes of



seamen or passengers were not brought into the United States, into large and small towns, and into hospitals filled with patients, with the yellow fever upon them and all their infected clothing. Yet in all this long period, no contagion appeared, altho no precautions, at least in many parts of the country, were ever taken to prevent it. If the disease contains specific contagion, surely that contagion must take effect under all circumstances. Every man knows that the variolous matter of the small-pox regards neither time nor place; its contagion acts in all years, seasons and climates, tho not with equal certainty.

This fact alone, that the bilious plague never shows itself in the temperate latitudes of America, except when the current epidemics of this country, manifest a general constitution of air, unfriendly to health, is sufficient to explain all the difficulties that have occurred to medical men and to others, on the subject of the origin and peculiar symptoms of the disease.

Some of these remarks are in anticipation of the subject of another section, but they fall naturally enough under this head, the design of which is, to establish the doctrine of the universality of certain diseases, at particular times, occasioned by a cause or causes extending often over a whole hemisphere, and sometimes over the earth.—That such is the fact, is demonstrated by the history of epidemics, from the earliest ages to this day. A successive series of similar facts, occurring age after age, leave no room for cavil or controversy.

I have confined my remarks, on this head, to the latest periods of the world, because the evidence is more complete. But a simple inspection of the preceding history, will convince any candid person, that the phenomena of pestilence have been uniform, from the highest antiquity. In the most barbarous ages, when commerce was unknown, all the severe plagues appeared in almost every part of the earth, in high northern latitudes, and among savage tribes which had no intercourse with the Mediterranean. The custom of deriving all plagues from Egypt, Syria or Turkey by specific contagion, is modern—it is pointedly contradicted by all history—is unworthy of the enlightened period in which it has been advanced—and marks an extreme degeneration in philosophy.



## SECTION XV.

*Of the phenomena which attend pestilential periods, with conjectures concerning the causes.*

**I**T will not escape the most inattentive reader of the foregoing history, that all the violent and general plagues have been preceded or accompanied with remarkable phenomena in the physical world, as comets, earthquakes, explosions of volcanoes, and others of a subordinate kind.

We are to admit, with great caution, the influence of the planets in producing the calamitous diseases which at periods afflict mankind. It is an influence very uncertain and undefinable. It is not indeed unphilosophical to suppose, the several immense orbs that compose the solar system, to have an influence on each other by means of the great laws of attraction and repulsion. The contrary supposition would be most unphilosophical. But it might be very difficult to ascertain precisely what that influence is, because it might not be possible to separate its effects from those which are produced by other causes.

The ancients went much too far in ascribing events on this earth to planetary influence. They ascribed not only natural, but moral effects to that influence, and by their extravagant system of judicial astrology, brought into contempt the study of the influence of heavenly bodies.

We are not however to discard all considerations of such an influence. We are naturally led to suppose that all parts of our system are connected by principles of attraction, and that a certain order and equilibrium are necessary to keep all parts in due harmony. It is very obvious that the moon has a most material influence in regulating the seasons and changes of weather on this

globe, especially the weekly and monthly vicissitudes. The more distant bodies may have a similar effect, tho less obvious.

Comets, which approach and enter the solar system at certain unequal periods, may also have some influence upon the seasons. To ascertain this point, I have collected all the information my reading has enabled me to discover.

The ancients believed these bodies to be the causes or at least the harbingers of pestilence; according to that line of Claudian

“In cœlo nunquam spectatum impunè cometam.”

“A comet in the heavens is never beheld with impunity.”

But should the fact be admitted, it might be still a subject of enquiry, by what means these erratic bodies injure the health of mankind. That they have some effect of this kind, seems to be very probable, not only from the opinion of the ancients who were careful in their observations, but from the very uniform coincidence of their appearance with extensive pestilence.

It is certain that comets have a very sensible effect on the weather. This was observed as long ago as the days of Aristotle, who remarks, *Meteorol. lib. 1. ca. 7.* “That comets denote great tides and winds.” He instances the swell of the sea when Achaia was inundated, which was during the appearance of a comet. Pliny makes a similar observation. “*Ventos autem ab iis graves ætusque significari.*” *Nat. Hist. lib. 2. ca. 25.* Seneca was of the same opinion, and he mentions storms of rain also among the effects of their approach. Seneca, *Nat. Quæst. lib. 7. sect. 28.*

It is true that great heat and drouth, and violent tempests mark the periods of the approach of comets, and it is equally true that the winters of the same periods are remarkably cold, Aristotle himself mentions the cold of the winter, during the appearance of the great comet, when Aristæus was archon at Athens.

The preceding relation of facts furnishes a confirmation of these opinions. All the comets which have approached this earth, in their passage to or from the sun, especially those which have passed very near us, have been preceded, attended and followed by most extraordinary effects, as great heat and drouth,

in summer, and severe cold in winter; deluging rains, violent tempests and unusual tides. These we may consider as the constant and certain attendants on comets. They occur so uniformly with the appearance of those bodies, and for some months preceding and following, as to leave no room to question the influence from which they proceed.

Through the medium of such great changes in the seasons, we may rationally suppose comets must affect the health of mankind. Extreme and unusual heat seldom fails to produce a multitude of autumnal diseases, as may be seen by the bills of mortality, and as the observations of every person can verify.

It is obvious from the foregoing history, that one of the most certain effects of the approximation of a comet, is, a most severe winter. The almost uniform coincidence of these two phenomena leaves us no room to doubt their connection. Now it is a law of the seasons, that the mean temperature of the air is nearly the same every year. This has been proved by seven years observations made at Salem by Dr. Holyoke, and published in the first part of the second volume of the *Memoirs of the American Academy*. Whenever therefore the cold of winter is long or severe in an unusual degree, it must be counterbalanced, in the succeeding seasons, by an extraordinary degree of heat. This may happen to be effected by long mild weather in spring and autumn; but it is more usual, that severe winters are followed by excessive heat in the summer months. In this case, the human body never fails to suffer. In such summers, bilious fevers and dysenteries are commonly numerous and violent.

If therefore comets do in fact produce unusually cold winters, which are necessarily preceded or followed by excessively hot summers, they may be considered as the remote cause of numerous diseases.

But comets do most evidently occasion at times excessive drouth; and at other times, extraordinary quantities of rain; and these intemperate seasons not unfrequently succeed each other within a few months. No man can question this fact, who attends to the preceding history. All such unusual seasons are apt to injure the vegetable kingdom. In too dry seasons, corn may

be defective in quantity ; in too wet weather, it is deficient in nourishing qualities ; and in both cases, it may contain the germs of epidemic diseases.

That comets should affect the health of mankind in any other way, than through the means of the seasons or weather, is possible ; but is not to be admitted without most indisputable evidence. It is indeed certain that the oriental nations believe, and have, from high antiquity, believed these bodies to be the forerunners of plagues ; and the enumeration of facts in the foregoing history, evidently confirms their opinions. That history is probably defective in accounts of comets ; but imperfect as it is, it affords proof that most of the plagues which have been extensive and severe, have been preceded or attended with the approach of comets.

From numerous facts in the history of pestilence, I am led to suspect that comets have some effect on the fire or electricity which surrounds and penetrates this globe. One of the most certain, as well as most remarkable phenomena, which attend plagues, is, earthquakes ; and in general, the more severe or numerous have been the earthquakes, the more violent and destructive the plagues. This remark applies to most of the countries in Europe, where the plague has been epidemic ; but is more especially true of Italy and the Syrian coast, with the whole of Asia Minor.

In confirmation of this remark, we need not resort to facts in ancient times, when earthquakes seem to have been more frequent and violent, than in modern times. Within the present century, the shocks which have uniformly attended pestilence, leave no room to question that some connection exists between the two phenomena.

Now it is a fact that will appear from an inspection of the preceding history, that, during the approximation of comets to our system, earthquakes have been most numerous, general and violent. A great proportion of the tremendous eruptions of volcanoes have happened during the same periods. To prove this, we need not go back to the terrible concussions and violent discharge of Etna, which closed the long pestilence in Athens, in the fifth



and sixth year of the Pelopponesian war—nor to the dreadful earthquakes and eruption, which preceded the destructive plague in the reign of Titus. We have similar facts in modern times. The plagues in the Levant in 1743, and especially in Messina, were accompanied or preceded by violent earthquakes and a comet. The extensive plague of 1760, was attended with all the great phenomena—comets, eruption of Vesuvius and tremendous earthquakes. The pestilential periods of 1770 and 1783, were introduced by the same phenomena.

These facts afford strong evidence that the approach of comets, not only influences the weather, but also calls into action the subterranean fires. By what means those erratic bodies produce this effect, may be a curious question. That the internal fires explode at times, without the attractive powers of comets, is undoubted; but the concurrence of earthquakes and violent discharges from volcanoes, during the appearance of comets, or near the time, seems to render it certain that those bodies have a most powerful effect on the element of fire which is diffused through the globe and the surrounding atmosphere.

Many authors have observed the connection between comets, earthquakes and pestilence, but seem not to have included volcanic eruptions among the causes of disease.

“In cœlo per quindecim dies apparens crinitum sidus siccatis plane terris attulerat; says Paulus Jovius; pestilentia quoque contagiis serpens, et in urbe et in Castris.” Hist. vol. 2. 111.

This observation of the writer is well founded—comets seldom fail to occasion a universal defect of rain and springs in some countries, and pestilence marches in the train with its other effects.

“Inter prognostica pestis est etiam cometes, jaculum et alia figuræ ardentes, diutius in suprema aeris regione subsistentes.” Horstius from Angelus Sala, de peste, p. 253.

These remarks also are justified by our own observations. They were remarkably verified in the comet, the meteor and the brilliant halo which marked the commencement of the last series of epidemics in 1788 and 1789.

Riverius is express to the same point. He asserts that comets



never appear without being followed by epidemic and pestilent diseases, and various changes in the physical world. He instances that of 1618, in his own days. The observation is verified by the testimony of all ancient writers and by a uniform series of modern facts.

The order of events is exemplified in the epidemic periods of 1769—and of 1782. In the first period, excessive drouth during the approach of the comet in 1769—failure of crops—famine and plague and insects in 1770—volcanoes, earthquakes and tempests in 1770 and 1771—catarrh and measles in 1772—then, for several years, anginas, putrid fevers and dysenteries. In the period of 1781 and 2, catarrh began the epidemics—in 1782 a universal failure of water, and of crops in India and Egypt—in 1783, volcano, famine, measles, angina and plague—in 1784 a comet, followed by tempests, &c.

Earthquakes constitute a part of the visible effects of the general cause which produces pestilence.

It has sometimes happened that in these convulsions of the earth, a vapor has been extricated which has produced immediate disease. The great earthquake in South-America in 1730 was speedily followed by a pestilential fever. The destruction of Port-Royal in Jamaica in 1692 was soon succeeded by a mortal fever in all parts of the island; and the universality of the fever would lead us to suspect that vapor, in this instance, could not have been the cause. At Venice in 1343, the plague soon followed an earthquake.

In the year 615, violent earthquakes in Italy were followed by “lues elephantia.” Baronius, vol. 8. 243. Baglivus relates that the great earthquakes in Italy in 1703, were succeeded by numerous diseases, especially ophthalmia, erysipelas, mesenteric fevers and double tertians. In autumn, the small-pox became epidemic, apoplexies were frequent and sudden deaths almost daily. With respect to apoplexies and sudden deaths after earthquakes, we have also the authority of Seneca.

Baglivus further remarks “post terræmotus frequenter succedunt pestilentia, vel morbi graves et epidemici, imo nova et inaudita morborum genera.” p. 530. The idea that new and

unknown species of diseases follow earthquakes, if well founded, leads us to suspect that the changes in the characters of diseases are attributable to the various action of the electrical fluid.

The terribly destructive earthquakes in Naples and Sicily in 1693, were speedily followed by malignant fevers, tertians accompanied with delirium and lethargy, and the small-pox which was very fatal to children.

Baddam's Mem. vol. 3. 91.

"Frequent earthquakes, says Fracastorius de contagione, p. 136, announce future pestilence, and by means of exhalations, tend to produce it." Van Swieten agrees in this opinion.

Seneca asserts, Nat. Quest. art. 27, that pestilential diseases usually follow great earthquakes. He supposes the air, enclosed in the earth, to become vitiated, either by stagnation or through the defect of the internal fires "*internorum ignium vitio.*" He thinks this air when forced into the atmosphere, renders it impure and unwholesome, generating new kinds of diseases. He reasons by analogy that as water corrupts by stagnation, so will air. Hence after earthquakes, "*subitæ continuæque mortes et monstrosa genera morborum, ut ex novis orta causis, nec prius pestilentia definit, quam spiritum illum gravem exercuit laxitas cœli, ventorum jactatio.*"

This opinion of Seneca is certainly entitled to respect, and has been followed by many distinguished authors, Van Helmont, Van Swieten, Sydenham, Hodges, Baglivus and others.

But I suspect the modern discoveries will enable us to furnish a more rational solution of the phenomenon. I am inclined to believe that a superabundant stimulus, occasioned by the shock of an earthquake, and an atmosphere furcharged with electricity, will more rationally account for the apoplexies, sudden deaths, small-pox and malignant fevers. If a deleterious vapor were the cause, I should suppose its effects would be speedy, and its force soon expended, the atmosphere being speedily purified by winds. But, if stimulus is the cause, it may exist for a long time in the atmosphere, and the human body not yield to its force in many weeks or months. This would better accord with facts, for altho diseases appear soon after an earthquake, yet the worst effects are often many months or a year after, as was the case in the

reign of Titus, when the pestilence was the year after the earthquake and eruption of Vesuvius.

There are however many authorities in favor of the vapor. Seneca relates that a vapor caused by an earthquake in Campania, destroyed six hundred sheep. Van Helmont says that "popular plagues do draw their first occasional matter from an earthquake." Page 1125.

The fact that a visible vapor, without an earthquake, sometimes appears suddenly in a place and evidently produces disease, is a strong confirmation of Seneca's opinion. A memorable example happened at Rouen, in 1753, as related under that year. Forestus relates that an epidemic catarrh or sore throat, in Alemar, A. D. 1557, suddenly invaded 2000 persons, of whom 200 died. He ascribes it to a vapor, for the disease was preceded by thick clouds of an ill smell.

See Van Swieten, vol. 16. p. 31.

Mazeray relates that the black pestilence of 1347 arose in China from a vapor, which burst from the earth with a smell most horribly offensive. This fact is cited by Boyle vol. 5. 60. in proof that pestilential diseases spring from vapors evolved from the earth. This author supposes new diseases may be generated by vapors, and remarks further that countries abounding with cinnabar escape the plague.

But it seldom happens that pestilential diseases can be traced directly to earthquakes. On the otherhand, altho great plagues are almost invariably accompanied with shocks of the earth, yet it more usually happens that the pestilence appears before the concussion. Thus the shocks which alarmed and laid waste Italy in 1348, 1349 and 1350, were preceded by the dreadful plague of 1347.

Sometimes the earthquakes precede the plague, but more generally the pestilence appears first, or at least the petechial or other malignant fever, which marks the commencement of the pestilence. Thus the plague of 1760 was preceded by a spotted fever in 1759, which marked the approach of the calamity; which spotted fever appeared in Syria, before the terrible earthquakes of that period.

In the well known plague at Oczakow in 1738 and 39, an

earthquake happened about the time the disease began to abate. Van Swieten, vol. 16. 47. Such was the fact in the days of Thucydides. Numerous observations on these phenomena lead me to suspect, that the electricity which is to produce the explosion, is in action for a considerable time *before* the shock, and that it is this *previous action* which occasions epidemic diseases. That is, the stimulus of fire or electricity produces sensible effects on the bodies of animals the more susceptible objects, before it does on the less susceptible substances in the bowels of the earth.

The earthquakes do not always occur in the seat of the pestilence. I find no concussion mentioned to have happened at London in 1665, or in the years next preceding or following; but shocks were experienced in the neighboring counties in 1665, and 1666.

This seems to have misled the able Diemerbroeck, who, in reasoning on the causes of the plague, objects to the influence of earthquakes, because no shocks occurred at Nimeguen, before the pestilence of 1636. It is probably true that earthquakes are not usually the *cause* of the plague; but that they have some connection with the cause, I can hardly doubt. The mistakes of Diemerbroeck and others on this point seem to have arisen from considering the plague as an isolated disease, and as depending on a cause local and temporary; whereas a just view of the subject must comprehend all the diseases of increased malignity which precede the plague, very often for two or three years. Such a view also must include, among the causes of the disease, the agitations or derangement of the elements in remote parts of the country. Thus, altho no earthquake was experienced at Nimeguen, about the time of the plague, yet a severe shock was felt at Lausanne in 1634.—Keyser's travels 190. This marked some general action of internal fire, which, tho it might not explode so as to shake all Germany, might have produced effects, by means of an insensible vapor or stimulus, in all parts of Europe. Certain it is, that for the period between 1631, the year of the tremendous eruption of Vesuvius, and the year 1637, all Europe was afflicted with mortal epidemics. The philosopher who would obtain just views of the causes, must extend his inquiries to



all the great phenomena, which occurred during this whole period, in all Europe at least, if not in the American hemisphere; for such a view only will comprehend the whole extent of the pestilential state of the atmosphere.

It must not be forgotten, that during this period from 1633 to 1637, when the plague or other desolating diseases, spread over both hemispheres, Etna was in a continual state of eruption; as it was for fifteen years, during the pestilential constitutions described by Sydenham in his days.

In looking over the list of comets, and the history of earthquakes, I am compelled to believe the approach of comets to have no small influence on the electricity and subterranean fires of the globe. Such a vastly great proportion of the violent concussions of the earth have happened, within a few months of the appearance of comets, that no reasonable man can suppose the coincidences to be the result of accident.

Equally remarkable have been the coincidences in time between the appearance of comets and the explosions of volcanoes. And this fact is no trifling confirmation of my opinion, respecting the influence of comets in producing earthquakes; for earthquakes and eruptions of volcanoes are often cotemporaneous.\*

\* It is not only during the appearance of comets, that their effects are perceived in the elements, but for many months before and after. I can testify from careful observations that the effects of that in August 1797, were very obvious, in anomalous tides, as early as the last week in May; and the inundations in England during the autumn and winter following, show its effects several months after its departure. The whole history of comets and their effects warrants this conclusion. Seneca made this remark seventeen centuries ago. These are his words,

"Aristoteles ait, cometas significare tempestatem et ventorum intemperantiam atque imbrium.—Non statim cometes ortus ventos et pluvias minatur, sed totum annum suspectum facit.—" Aristotle observes that comets indicate storms and violent winds and rain.—These effects however do not immediately follow their appearance, but are to be expected, during the whole year." He then mentions that such was the fact, with the comet predicted by Aristotle and Theophrastus, and which appeared in the consulship of Paternulus and Vapiscus. Nat. Quest. lib. 7.

I would further observe that comets move in trajectories of an elliptical or parabolic form, the sun being situated in one of the foci. The time when we observe them is when they pass this part of the ellipsis. Now according to the universal law of planets, by which they describe equal areas in equal times, their motion must be most rapid when nearest the sun, and within our sight. Before their appearance, and after



I cannot however admit, that the explosions of subterranean fires, are the direct exciting cause of pestilential diseases. It is indeed ascertained, beyond all question, that periods of extensive pestilence and mortality are remarkable for earthquakes and eruptions of volcanoes. But the explosions of fire do not so generally *precede* epidemic diseases, as to authorize the supposition that they *produce* those diseases. Earthquakes occur, during the prevalence of pestilential or other mortal epidemics, but in the midst of the period, or sometimes at the conclusion.

Hence I deduce an opinion, that pestilence and earthquakes depend on one common cause; which excites into action the internal fires. But I suppose the action or fermentation may precede, for months and even years, the explosion in earthquakes and volcanoes and by means of an insensible vapor, or heat or electrical discharges, the elements of water and air may be essentially affected, in such a manner as to impair the principles of animal and vegetable life. Whether this is a just explication of the cause, may be a question; but so many phenomena concur to authorize it, that I cannot withhold my assent to the general principle.

The same effect perhaps may be produced by the excessive action of mere stimulus upon the animal system, without the infusion of a deleterious vapor into the air.

A remarkable evidence of the effects of fire or electricity on the earth and air, before its explosion, is the extreme drouth which is often experienced over whole continents or the

their departure, their movement is slower, than when within the solar system, and they may be near the earth, many months before they enter the system or become visible. Hence their influence on the earth so long before and after their appearance.

It is further to be observed that many comets doubtless enter the system and pass round the sun without ever being seen, and such as come from regions of space directly opposite to the earth, must be *invisible*, unless we can see them in the splendor of the sun's rays. This remark is as old as Seneca and older. He relates an instance, in which Posidonius discovered a comet, in the darkness of a solar eclipse, which would not have been seen, had not the eclipse happened. Lib. 7. sect. 20.

Newton and Halley have made the same remark. Hence perhaps we may account for violent seasons, like the severe winter of 1780, which happened without the appearance of any comet. This is mere conjecture.

whole world, for six and even twelve months antecedent to a great eruption of volcanoes.

In confirmation of my principle, that the changes in the elements producing epidemic diseases, are effected by the all-pervading action of electricity, the usual appearance of meteors or celestial lights, in pestilential periods, must be mentioned. For the truth of the fact, we have ample proofs in every age. The instances of meteors or other celestial appearances of fire, which are recorded of pestilential periods, are so numerous, as to leave no room to question the connection between the cause of pestilence, and the fire that belongs to the system. Sometimes these fiery appearances are stationary lights in the sky, which the frightened imaginations of men have formed into armies ready for combat, and considered as the preludes of bloody battles. Sometimes the heavens have been filled with those small meteors, called falling or shooting stars. At other times immense globes of fire have traversed the celestial regions, and burst with a tremendous report.

During a plague in Vienna in 1679, says Van Swieten, vol. 16. p. 19. from Sorbait, several bluish fiery balls were seen in the air, some of which fell and sensibly increased the heat.

In October 1709, when the plague was in Dantzick, a blue fiery globe came from the north west and shot over the town with amazing celerity, illuminating the town and falling at the southward.

Baddam's Memoirs, vol. 6. 14.

During the plague in Philadelphia in 1793, about the 12th of September, a meteor fell between the city and the hospital.

Rush. p. 108.

During the extreme heat which introduced the pestilence of the last summer, 1798, about the 9th of August, the small meteors or falling stars were incredibly numerous, for several nights. They almost all shot from the north-east to the south-west, and succeeded each other so rapidly as to keep the eye of a curious spectator almost constantly engaged.

Diemerbroeck remarks that during the summers of 1635 and 6, at the time of the severe plague in Holland, there was a vast number of ardent stars, gliding through the celestial regions and

falling to the earth. “*Stellarum ardentium in Cælo oberrantium magnus concursus, et in terram prolapsio.*” He mentions likewise almost continual flashes of light, in a serene sky, or silent lightning.

Livy mentions that the heavens appeared to be in a flame, previous to the severe pestilence of the year 290 from the building of Rome.

A flame in the heavens is noted under the years, 733, 742 and 788, all which were pestilential. This flame is not described, and whether it was of the species of *Aurora Borealis*, which extended over the celestial region, or of that species of light, or yellowish red colour, which distinguishes our modern *dark days*, cannot perhaps be determined. But a curious phenomenon of this kind happened in the severe winter of 1741, which was too remarkable to be passed over in silence; especially as it may possibly explain what Livy and many other historians have recorded, that at certain times, “it rained blood.” The assertion is often found in historians of credit, and has by the moderns, been numbered among the extravagancies of popular credulity. But an appearance which would warrant such an assertion occurred in this country, and is still recollected by old people.

In the month of January 1741, in the midst of one of the coldest winters of this century, there was a little relaxation of the rigorous cold, during which the heavens were overcast with clouds and a little rain fell. Late at night, during this falling weather, the heavens appeared all in a flame, so bright as to illuminate the earth and render objects every where distinctly visible. Many people saw it and were alarmed, supposing the great day was at hand. The rain which fell during this light, had precisely the appearance of drops of blood distilling from the clouds.

This relation is taken from my father, who was then nineteen years old, and recollects all the circumstances more minutely than the events of the last year.

The well known dark day in May 1780, was distinguished by a similar light in the heavens; but not occurring in the night, it was less an object of wonder.

I strongly suspect a similar phenomenon will account for those passages in many histories, which speak of raining blood, and enable us to do justice to the veracity of the writers.

Appearances of this kind have usually occurred in periods of pestilence, when the imaginations of men have been subject to alarm; and they have often happened during extraordinary seasons. The light of 1741, was during a most severe winter, and in the most sickly period, that has occurred this century. See the London bills of mortality. In America, that winter was followed by pestilential diseases.

The dark day of 1780, was on the opening of spring, after a most severe winter, and altho that year was not sickly in general, yet in the year following, we had an epidemic catarrh, succeeded by a series of epidemic diseases of other kinds. It is remarkable too that on that very day began a violent eruption of mount Etna.

In 1716, in the month of October, happened a dark day; this was after a most severe winter in Europe. I have no account of the seasons in America, but the next winter was unusually severe, and snow fell in extraordinary quantities.

On the 9th of August 1732 happened another dark day. This was followed by earthquakes, a severe winter and universal catarrh.

The 19th of October 1762 was equally remarkable for darkness, with the phenomenon of a red, or yellowish tinge in the heavens, which gave to the sun, when it appeared, the color of blood. Some rain fell during the day, and the water was of a dirty sulphurous smell. There had been two earthquakes, with epidemic catarrh, in America in 1761. In the same year with the darkness, 1762, the catarrh was epidemic in Europe; and the winter of that year was excessively severe in both hemispheres. A comet appeared in 1762 and an eruption of Etna followed the severe winter, in 1763. There were earthquakes also in Asia in 1762. Who can doubt that the vapor, occasioning such darkness, is the effect of the agitation of the fire of the globe?

Similar instances of extraordinary darkness have occurred in



every age. They are mentioned in the years before Christ 366 and 295—and of the Christian era 252, 746, 775, and in many other periods. And the reader will observe, this darkness is cotemporary with pestilence, in almost every instance. During the plague of 746, the darkness was of several days duration—in 252 it was of three days, and in 775 of six days continuance. A similar darkness accompanied the pestilence in Egypt, in the days of Pharaoh. Many other instances have been mentioned in the preceding history.

In America, it has been customary to ascribe this unusual appearance to condensed volumes of smoke, after the burning of immense tracts of woods in the western parts of the country. But I cannot learn that any great fires have usually preceded these dark days; and negative evidence, in so many instances, amounts to proof that no great forests have been burnt. Besides, the same phenomenon has been often observed, in countries where there were no forests, as in Italy, Syria, Asia Minor and Egypt, and especially in England.

That the smoke of burning forests cannot be the cause may be rendered very certain by these considerations. First, the cause is not equal to the effect. Had the woods from the 40th degree of latitude in America to the 50th been all consumed in a day, the smoke would not have been sufficient to cloud the sun over the territory covered by darkness on the 19th of May. Any person may judge of this who has seen large tracts of forest on fire. That thirty or forty miles of burning forest, should cover five hundred miles with impenetrable darkness, is too absurd to deserve a serious refutation.

In the second place, the color of smoke, when elevated into high regions of the atmosphere, is very different from that of the vapor which causes the darkness on all such occasions.

But what decides this question is the lightning, thunder and rain, and especially the meteors that accompany these clouds of vapor. As far as I can learn, some or all of these phenomena attend dark days. Thunder was heard on the morning of the 19th of May, in most places. *Mem. Am. Acad.* vol. 1. 238. Violent thunder squalls and a meteor followed the great darkness



in Canada in 1785. These phenomena demonstrate that the clouds, on such occasion, have a connection with electricity. This is further evidenced by the smell of sulphur, in the water that falls, and the scum that is left on objects—smoke would not produce either; nor would the largest volume of smoke ever raised into the air, spread over an extensive region, a dense substance that should become visible and tangible on the earth. Besides this darkness or vapor sometimes occurs in winter, when the earth is covered with snow.

When we connect with these facts, the circumstance that these dark days always occur, during or near the time of volcanic eruptions, earthquakes, or the unusual seasons which accompany pestilence and epidemic diseases of other kinds, we shall be at no loss to charge them to the account of the central fires, or the discharges of electricity. This accumulation of vapor is not a more surprising phenomenon, than the sudden change in the properties of the atmosphere which produces universal catarrh.

Hodge, who wrote on the plague of London, and who appears not to have been rewarded with celebrity equal to his merits, supposes the cause of pestilential diseases to be a subtle aura, or vapor exhaled from the bowels of the earth, which has, by too much heat and humidity, lost its wholesome qualities. He says, in proof of his opinion, that a given quantity of earth, infused into water in spring, deposits more salt than at another time of the year.

His idea seems to be not very different from that of Van Helmont, who supposes the cause of pestilence to be a gas or air, which has *putrified by continuance*, as the translation is; by which is meant, probably, a stagnation in the earth.

The doctrine of an insensible vapor, infused into the atmosphere from the bowels of the earth, may perhaps be thought wholly conjectural. But there are some phenomena which can hardly be resolved without resorting to the action of the electrical fluid. The sudden changes of weather cannot be accounted for, in all cases, by changes in the winds. Indeed the most reflecting philosophical men acknowledge themselves puzzled to assign reasons, for many of the rapid transitions from heat to cold and

from cold to heat. It has been suggested, that the heat may ascend and descend in the atmosphere, by means of physical laws, to us unknown; but this supposition is not supported by any clear proofs, perhaps not by rational probabilities.

There are many reasons which incline me to believe that the principle of fire, the most subtle, penetrating, active fluid in creation, and unquestionably the most powerful agent in all the movements of matter, passes more frequently and rapidly from the earth into the atmosphere and vice versa, than is commonly imagined. I suspect that an intimate connection subsists in this respect, between the interior of the globe, and the atmosphere which surrounds it.

To the rapid passing of heat from the earth to the air, and from the air to the earth, we may perhaps ascribe many of the amazing changes which take place in the temperature of the air, in a few hours, and often without a change of wind. The increase and the moderation of cold are sometimes very obvious, long before the change of winds to which we usually ascribe such changes; and I suspect that the changes of winds are more frequently the *effect*, than the cause, of a change in the temperature.

But there are some appearances, in the atmosphere, previous to shocks of earthquake, which demonstrate a close connection between the atmosphere and subterranean fire. A remarkable one in this country, and generally in others, is a universal serenity and tranquillity in the atmosphere. The sky is cloudless, and all nature, if at night, is wrapped in profound silence. This phenomenon is too uniform a precursor of earthquakes, to be deemed an accidental circumstance. It must be an effect of some connection between the air above, and the cause of earthquakes.

It is remarkable also that seamen sometimes observe a swelling of the ocean, without wind, and before any shock of the earth; and this fact, Pliny mentions among the signs of an approaching earthquake.\* The same author mentions a well known fact that

\* Is not this swelling of the ocean, previous to an earthquake, analogous to the tides? May not both be ascribed to the force of electricity; the swell of the water preceding earthquakes being irregular, as depending on no regular visible cause; and the tides being more regular, as being the effect of the moon's influence on the electrical principle. This idea seems to derive some strength from the known fact that earthquakes

sometime before the concussion, birds appear to be greatly agitated, and retire. In Italy, a common prelude of an earthquake is, a thin white oblong cloud or vapor, nearly resembling the color of wool. This sign was seen for several days in the year 1702, before the earthquake. The same was observed by Cassini in 1668, in the same part of the heavens, the sign of the whale.

See Pliny, lib. 2. 81. Baglivus, page 543.

The evening before a violent earthquake in Sicily in 1693, a bright flame was observed, apparently about a mile distant from the spectator; this flame vanished as soon as the shock occurred.\* The day succeeding the first shock, the sky was darkened, and tinged with a deep yellow. This was the preface of a most tremendous concussion, which demolished many towns in Naples, Sicily and Malta,

Seneca relates that a violent earthquake in Campania, altho in winter, was preceded by a calm of several days duration.

Nat. Quest. lib. 6. 12.

For sometime before the great earthquake in Italy in 1638, the air was perfectly calm, and the heavens serene, but the sea was covered with little bubbles, as if agitated by drops of rain.

The phenomena that occurred in Germany and Holland, on the day, but *not at the hour* of the tremendous earthquake

usually happen in periods of the moon's revolution, when that orb exerts its greatest influence on the earth. From numerous calculations, it appears that earthquakes usually occur near the moon's perigee or apogee or the change or conjunction of sun and moon; generally about three days before or after the conjunction—this, by the way, is the very time when epidemic diseases usually invade the patient, or come to fatal termination, according to the remarks of all modern physicians—a singular fact that may lead to important conclusions.

In a few instances, earthquakes happen near the full moon—the other position in which that satellite exerts more than her ordinary influence on the earth.

Let these facts be compared with the occurrence of violent tempests about the same time of the moon's revolution, the invasion of epidemic diseases and the full tides.

A strong confirmation of this opinion is derived from the swelling of the sea, just before a hurricane in the West-Indies. There is a visible intumescence, before the atmosphere is clouded, or the least breeze of wind. What can be the cause, but the electrical fluid which is passing from the earth to the atmosphere, and is speedily to produce most tremendous effects. See the Addenda.

\* A similar light was seen at Derby in Connecticut, in the evening preceding a local explosion of fire, about thirty years ago.

which demolished Lisbon in 1755, were very remarkable. The water was violently agitated, buoys were broken from their chains, large vessels snapped their cables, smaller ones were thrown ashore, boats in canals were forced from their fastenings, chandeliers vibrated in the churches, water in small vessels was agitated and dashed over the sides; and all this without any sensible motion of the earth or buildings.

See Encyclopedia, art. Earthquake.

These phenomena indicate a connection between the atmosphere and the subterranean fire, which is altogether invisible, and to men, imperceptible. We perceive nothing, before the shock but universal serenity and calm; but the delicate senses of the fowls of heaven are affected; they fly about in a fright and appear to want the usual support from the air. The waters of the ocean also swell, altho no concussion of the earth or water can be perceived. Do not these phenomena indicate, either a want of the usual weight or elasticity of the air? Or what defect is there in the mass of air surrounding the earth, which is to be supplied by an explosion of subterranean fire? That there is a connection or dependence of the fire above on that beneath the earth, and that this subtle fluid acts and reacts between the earth and the air, with a rapidity and a force beyond all calculation, is to me extremely probable. The appearances that precede earthquakes indicate, that the fire which is to produce the shock, is in violent action, for a considerable time, before the shock. For several days before the earthquake at Oxford, Sept. 17, 1683, *ignes fatui*, luminous appearances, were frequently seen.

Baddam's Memoirs, vol. 2. 208.

It sometimes happens that hot springs burst forth before earthquakes; and miners perceive heat in the earth.

Often have earthquakes been preceded by a perturbation, a stench, or discoloration of the water in wells and springs.

Sometimes the water in wells and rivers recedes or is evaporated before the explosion. It is said that Pherecydes once predicted an earthquake in Lacedemon, from the disappearance of the water in a well.

Pliny, Nat. Hist. lib. 2. 79.

The rivers and small streams in Iceland are observed to be-



come entirely dry for some weeks before an eruption of Heckla, as was the case in 1783. Meteors also, earthquakes and sometimes flashes of lightning precede or accompany the eruptions.

See Van Troil's Letters on Iceland.

The various sounds or noises which precede and attend earthquakes, are a strong confirmation of these ideas. The usual premonitory sound is compared to the rattling of carriages on a pavement. Sometimes it is described, as the rumbling of distant thunder. But in truth the sound is different at different distances, and resembles no other sound in nature. It is altogether sui generis. It is most analogous, when near, to the rattling sound from a near explosion of the electrical fluid; as those can testify who have been near the place where lightning has fallen upon objects. It bears no resemblance at all to any artificial sounds, made by the explosions of gun-powder, or other human contrivances. It is most unquestionably the effect of the electrical fluid, rushing from one part of our system to another—probably from the earth to the atmosphere, to restore the equilibrium, which has been, by some means, destroyed, or to answer other unknown purposes. This idea corresponds with the modern theory of earthquakes, which ascribes them to the electrical fluid. See the Encyclopedia, art. earthquake. Let it be observed that at sea, no sound precedes an earthquake; water being a good conductor of electricity.

Eruptions of volcanoes have also been preceded many weeks by a visible fog or vapor, suspended over the mountain, as happened before the great discharges of Heckla in 1783. To what cause shall we ascribe this, but to the action of fire which precedes the explosion? And if a visible vapor may be extricated by this action, for *months* before the explosion, of which we have *certain* evidence, why may we not suppose, a smaller action or force to expel an invisible vapor, in any place and at any time?

Other facts authorize this conjecture. On the 12th of September 1784, the water of the Loch Tay in Scotland, suddenly receded 300 feet and left the channel dry; then returned; continuing this vibration for every seven minutes for two hours, and at the same hour in the day, for a week, with less violence.



No wind was stirring, and no visible cause could be assigned for this novel phenomenon. To what cause shall we resort for a solution, but to the invisible energy of electrical fire ?

Sinclair, vol. 6. 623.

If we admit then the action of electricity to be the cause of earthquakes, we shall have reached the general proximate cause of those epidemic diseases which speedily succeed concussions of the earth. The cause must be the action of fire, the most energetic principle in nature. The manner in which this effect is produced, whether by forcing an unwholesome vapor from the interior of the earth, and vitiating the atmosphere ; or whether by simply changing, on mechanical principles, the proportion of oxygen contained in atmospheric air, or by mere stimulus or other unknown means, is a question of a curious nature, and worthy of philosophic investigation.

One thing is very evident, that what I denominate a *pestilential principle*, does, at certain times, pervade not only the element of air, but the water also. The proofs of this are abundantly numerous and convincing. In all the great plagues which have afflicted the human race, other animals, as horses, cattle, sheep, sometimes cats, dogs and fowls, together with the fish in rivers and the ocean, and even vegetables, have borne their share in the calamity. The pestilential principle has extended to every species of life. The beasts of the field perish with deadly epidemics ; the fish die on the bottom of rivers and the sea, or become lean and sickly ; while corn is blasted on the most fertile plains, and the fruits in gardens and orchards, wither or fail to arrive at their usual state of perfection.

In the destructive plague which desolated Italy in the time of Romulus, Plutarch and Zonaras mention a general sterility of the earth ; the very trees were affected, and all nature appeared to be defective in its powers of production.

In the beginning of the pestilential period, in the reign of Justinian, Baronius states that corn was deficient in quantity, and defective in its nourishing qualities.

About the year 1600, crops failed in all parts of Europe ; as they did in both hemispheres, about the close of the last centu-

ry. Such was the case in 1740, in some parts of Europe; and in 1766. The failure of grain in India in 1770, and in 1783 and 1789, are still remembered; and in some of these instances, the crops failed, at the same time, in China, India, Europe and America.

When excessive rains or dry seasons precede this failure of crops, men are at no loss to assign the cause; altho, in these cases, they may sometimes mistake the true cause. But it often happens that grain fails of its usual perfection, in seasons apparently the most temperate and favorable. Observing farmers remark that, in certain years, when blast or mildew is expected from intemperate weather, grain proves to be good; at other times, the grain will shrink very much, under a series of weather apparently the most propitious. This has been observed in Fairfield county, in Connecticut, where the excellent lands formerly produced great crops of wheat, with as much certainty as any other grain; but within a few years past, wheat has failed, without any apparent cause. In some cases, the farmer scarcely receives his seed, altho the seasons are favorable and no insect appears.\*

The failure of certain species of fruit-trees and shrubs is a fact equally remarkable.

Some kinds of apple, for a few years past, have been small, knotty and sprinkled over with specks.

The plum-tree has become full of warts, or bulbous excrescences, which kill the tree, and in some parts of our country, bid fair to extinguish the species. These have been suspected to proceed from a fly or small worm; but on examination by a microscope, I find reason to question this fact. Some of the excrescences contain a small white worm, about a line in length; but they perforate the wood after the excrescence is formed, as appears by their path; and some of these warts contain no insect whatever. The insect therefore finds a nidus in the excrescence, but is rather an effect, than a cause. The bursting of the bark is a disease, which seems to have begun or been very much increased, during the present pestilential period.

\* The same was the case in all the eastern states for three or four years; but in this summer, 1799, the wheat has every where a full grain.

The peach-tree has, within a few years, been particularly subject to be destroyed by a worm, which attacks it just below the surface of the earth, and separates the bark from the wood. If this is a common evil, still the vast increase of it, at particular periods, is among the phenomena of pestilence. The locust is perishing by a similar malady.

Cotemporary with these diseases of the plum and the peach, has been a distemper of the pear, usually called the pound pear, one of the most delicious of the species. For eight or ten years past, that fruit has been, universally in the part of the country to which my observations have extended, subject to a blast, from a species of rust which covers a large portion of its surface. In my own garden, not one in five is fit to eat; but I have seen one gentleman in a neighboring town, who thinks the pear is beginning to recover.

The universal death of the prim is a phenomenon still more extraordinary, and a most severe calamity. The town of East-Hampton on Long-Island, lost, in two or three years, two hundred miles of hedge—a greater loss, says Mr. L. Homamdiou, in a paper published among the transactions of the New-York Agricultural Society, than if every house in the town had been burnt to the ground; as no proper substitute for fences has yet been discovered. The English black thorn has been tried, but has failed, owing to a fly that perforates the bark.

See part 2. 103.

The cause of the death of the prim is not known, nor the precise time when it began. But in Connecticut the failure was observed about twenty-five years ago; between the years 1770 and 1777, during the prevalence of the terrible angina and dysentery among men. It continued gradually to extend for some years, and the prim has at last totally disappeared.

It is remarkable that these diseases among corn, fruit-trees and shrubs have generally, if not always, appeared first on the Atlantic shore, and gradually extended themselves into the interior country. This is an observation made by many men in different parts of Connecticut. May we not from this circumstance, deduce an argument, that the *infection is imported*!!!

But these phenomena are not *new* in the world ; they are new only to people who do not read. Avenenna, the Arabian physician, an author of great celebrity, says, that " the state of air, called corrupt, either impedes the growth of plants or covers them with rust." Diemerbroeck, de peste, p. 40. 41, enumerates, among the effects of a pestilential air, the corruption of grain and fruits, the production of mice and noxious insects which corrode and devour the corn ; the sterility of the earth, which fails to yield the usual quantity of grain and fruits. He takes notice also of another fact, which is, the unusual disposition to putrefaction in all kinds of fish, flesh and vegetables, during pestilence. This putrefaction, is, by the moderns, considered as a fruitful source of diseases. In some cases it may be so ; but it is always an *effect* of the same cause which produces epidemics.

Another remarkable fact to prove the universality of the pestilential principle, is the sickness and death of fish in rivers and the sea. Several examples are recorded in ancient history. See the years 590, 994, 1240 and others. The number however of such facts is not great, in the old books ; and whenever this phenomenon occurred, it was ascribed to frost, to a battle among the fish, or other improbable cause.

In modern times we have many examples recorded, but probably many others have escaped observation ; or been considered as things of no moment to mankind ; for within a century past, the opinion that the plague is propagated, in northern climates, by contagion only, seems to have suspended all rational enquiries into the cause of the disorder.

That the fish on the British coast or in the rivers, perished, during the last great plague in 1665, I find no where related, in a manner to render the fact certain ; but I find Hodge has mentioned a fact of that sort as a proof that pestilence is occasioned by an unwholesome vapor from the earth.

The death of the haddock on the coast of Norway in 1789, has been already mentioned, but as there were many shocks of earthquake in Scotland, about that period, it is not impossible that the haddock might have been suddenly killed by some concus-



sion of the water. A similar event took place on the American coast, in the great earthquake of November 1755, when some whales and multitudes of cod were killed, and seen afterwards floating on the water. I throw all such cases out of the question, and confine myself to the sickness and death of fish, when there has been no concussion of the waters, to occasion a violent death.

The disappearance of the blue-fish from Nantucket, in 1764, just after the great mortality among the Indians, is a remarkable fact. Not less singular was the sickness and extinction of the Wellfleet oysters in 1775, the year of a fatal dysentery in America. Still more remarkable was the sickness or ill-state of the cod-fish taken on the banks of Newfoundland in the year 1788. They were thin, unfit for use and when preserved, turned to a blue or dark color.

Aristotle remarked that no one pestilential disease appears to affect all kinds of fish; but that these animals are subject to sickness, which is known by their being thin, and not changing their colors.

De Hist. Animal. lib. 8. ca. 20.

But to come still nearer to the present time. In the years 1793 and 4, the oysters on the coast of Connecticut and Rhode-Island, were all sickly, watery, and tasteless; wholly unfit for food, and in some instances, brought on nausea or sickness in those who ate of them. This was the very time when the scarlatina was spreading over the country, with malignant dysentery and typhus.

The shad which came to the New-York market in the spring of 1796, which was the period of pestilence in New-York, were leaner than usual, and perished, in defiance of the powers of salt.

In 1797, multitudes of small dead fish floated down James river in Virginia. It is remarkable that in the summer following, all the country from Norfolk to Philadelphia, the very latitudes through which that river passes, was very sickly; Norfolk, Baltimore and Philadelphia were all afflicted with the bilious plague.

I have been informed, that many dead shad were seen to float down the Susquehanna, in June 1798; but of the fact, I have not satisfactory evidence.

The reader cannot fail to remark here, the correspondence in

place between the epidemic diseases in the water and the air ; the fish and the human race, in *contiguous* regions, being diseased about the *same time*—a fact too remarkable to be permitted to escape particular observation.

The mortal pestilence among cats, in Europe and America, in 1797, is a fact too well known to be repeated. The sickly state of the water in the wells of New-Haven, during the pestilential period of 1795 ; was evidenced by the number of animalculæ it contained.

Paracelsus mentions the death of fish but ascribes it to the influence of the planets.

Vol. 1. 167.

Sorbait relates that in the time of the plague at Vienna, I suppose in 1679, a fountain in the suburbs, which had been esteemed for the salubrity of its waters, exhaled a stench which appeared to increase the mortality in the vicinity. Van Swieten Vol. 16. 47. It is probable that Sorbait has mistaken the effect of this stench ; it is probable the great mortality in the vicinity and the impurity of the water proceeded both from one source, an uncommon effusion of subterranean vapor in that particular quarter, or other unknown cause.

All these phenomena denote a pestilential cause in water as well as air. Whether that cause is a positive substance infused into the elements from subterranean regions, increasing the due proportion of oxygen ; whether it is a negative state of the elements, occasioned by the abstraction of oxygen ; or whether it is occasioned simply by a chemical alteration in the elements, by the mechanical operation of the electric fluid, which may produce new properties in air and water, by means of new combinations of their parts, are questions not easily solved. But without attempting to penetrate into the mysteries of nature, and unfold primary causes, we may be certain of their effects, and from this branch of knowledge, may deduce useful conclusions.

We know, for we see, the effects of some mortal principle, which, at particular periods, destroys or impairs the usual powers of life, through the animal and vegetable kingdoms. We rationally conclude that this cause must be general, affecting the elements of life, over whole regions of the earth, and beneath the

waters of the ocean. Of so much we are certain. As to the primary or remote causes, we shall probably remain in the dark—and as to the proximate causes, we can only indulge a rational spirit of philosophical enquiry, that may lead to probabilities.

Sydenham is among the most respectable authorities for the doctrine of a change in the properties of air from a subterraneous vapor. His words are, vol. 1. p. 8. Wallis's Edit. "There are various general constitutions of years, that owe their origin neither to heat, cold, dryness nor moisture; but depend rather on a certain secret and inexplicable alteration in the bowels of the earth, whence the air becomes impregnated with such kinds of effluvia, as subject the human body to particular distempers, so long as that kind of constitution prevails, which after a certain course of years, declines and gives way to another."

The reader will recollect that when the plague first broke out in Athens, the people alledged that their enemies had poisoned the wells. In the mortal plague of 1349, the Germans suspected the Jews had poisoned the wells, and vented their rage upon the harmless Israelites. These suspicions doubtless arose from the bad quality of the waters, similar to what was observed in New-Haven in 1795: And the suspicion of poison was full as well founded, as the modern doctrine of importation, in most cases of pestilence.

The death of fish in rivers and the ocean, is one of the strongest arguments to prove the cause of pestilence to be a subtle vapor, expelled or exhaled from subterranean regions. That fish do in fact die of epidemic diseases, is a fact as well authenticated and as certain, as that epidemic diseases affect the human race—and it is equally certain that such mortality among the fish, is usually cotemporary with pestilence among men, on the adjacent shores. From these facts, we are powerfully inclined to believe, the general cause which affects the one species of animals, to be the same which affects the other species. This conclusion is easy, natural and irresistible.

What then can be the principle which penetrates the waters, and reaches the animal functions of fish and oysters on the bottom of the sea? Can it be a vitiated state of the superincumbent

atmosphere? Can a deleterious principle, belonging to the air, find its way through a mass of water, and destroy life, as effectually as in its natural fluid, on the surface of the earth? These are questions, I pretend not to solve. But I cannot help thinking that the only efficient cause, within our narrow comprehension, capable of extending the principle of destruction through the different elements, is the all-pervading energy of fire or electricity. The *modus operandi* is among the impenetrable arcana of the physical world.

It may not be useless to introduce here an observation made by elderly people in America, that in sickly years, the aurora borealis does not appear. It is certain that during the present pestilential period, since 1790, that phenomenon has never been observed, at least not in any distinguished degree of brightness.

But the history of the aurora borealis does not warrant the justness of this observation, as a general fact. The years 1564 and 5, which were distinguished by northern lights, were sickly in Europe, and in many parts raged the plague. The same lights were very splendid in November 1575, a year when the plague was spreading over Europe with unusual violence and mortality. The same were repeatedly observed in 1580, the year of a most severe universal catarrh, when the plague raged in Paris, and when Cairo lost 500,000 people by the same disease. These lights were again visible in 1621, and described by Gassendus in France, who it is said gave them the name of *aurora borealis*. That year was noted for a most fatal epidemic small-pox and the Hungarian fever in Europe; and the plague which raged among the Indians in America in 1618, had not ceased in 1621.

From this time to the year 1707, we have no account of the appearance of these lights. In that year, they appeared, but not of a remarkable brightness. If these lights appeared in this long interval, from 1621 to 1707, it is strange that astronomers should have left us no account of them. Certain it is, that the great Halley never saw this phenomenon till the year 1716, when he was 60 years old, and he began to despair of ever beholding it. During this long suspension of the aurora borealis, epidemic pestilential diseases occurred very often in both hemispheres.



In the same interval, these lights were never seen in America; and our ancestors, when they first beheld them, at the beginning of this century, supposed them a new phenomenon in creation; the memory of them having been lost.

In 1719, in November, appeared these lights; which was at the commencement of a sickly period of great severity and extent—the plague was then raging in the Levant. A splendid phenomenon of the same kind was observed in Feb. 1720, the most unhealthy year of that period. The same in the three following years, and in 1725, 1726, 1728, 1730, repeatedly in 1733, a sickly year, repeatedly in 1735 and 36, very sickly years, when the mortal fore throat prevailed—also in 1737.

From these facts, we conclude that the cause of pestilential diseases, has no connection with these visible phenomena of the electrical fluid, as they are observed indifferently in healthy or sickly years. It is evident however that the *lumen boreale*, is, in a certain degree, periodical.

Let us attend now to the effects of a pestilential state of air and water, in the production of insects and small animals. This is one of the most remarkable symptoms of a sickly state of the elements, and it is the more necessary to insist on this phenomenon, because it is visible to every eye, and carries with it, during pestilence, a demonstration of the doctrines for which I contend.

In the threshold of the history of plagues, we meet with accounts of myriads of noxious insects, accompanying these calamities. The ten plagues of Egypt are numbered among the miraculous interpositions of providence, in favor of his chosen people. But so far as regards most of those plagues, we find, by subsequent events, they are usual occurrences during pestilential periods. Such are swarms of insects called in scripture flies and lice, and especially locusts, which, at this day and in every age, are generated, in unhealthy periods, in such numbers as to darken the sun, when on the wing, and which often devour every species of plants, and even the bark of trees. These animals seem to have their origin in the deserts of Arabia, bordering on Egypt and Syria; but they have often overspread all Palestine, Judea and Italy—sometimes they have penetrated into

Germany, Poland and Russia. It is unnecessary here to enumerate the instances related in the foregoing history, of the ravages of these animals; the reader has observed that instances of their appearance have often occurred in different periods, and that they are always the harbingers or the companions of the plague.

This fact leaves no room to question, that the same state of air in the oriental regions, which will generate epidemic diseases, will often produce those animals in unusual numbers. They do not indeed always attend the plague; the particular season most favorable to their generation is an excessively dry one; but it is obvious, that they rarely appear in desolating swarms, except in periods when the neighboring countries are afflicted with mortal epidemics.

It is true that, in two or three instances, history informs us, dreadful plagues have originated from the putrefaction of these animals—the instance of the pestilence on the African coast, about 126 years before the Christian era, is memorable. But while this fact is not disputed, we must observe that the same period was distinguished for pestilence in other countries, where no such local or particular cause existed. Great swarms of locusts therefore in the eastern countries, *may* be the cause of pestilential diseases, but always by accident; whereas they are certainly the forerunners or companions of that calamity.

See the years 394, 590, 677, 1031, 1084, 1091, 1186, 1234, 1337, 1476, 1646 and 7. Also before the Christian era, the locusts of the year 206 and 174.

In the destructive pestilence which almost extinguished the human race, in the reign of the Antonines, about the year 167, the earth was overrun with caterpillars.

During a most mortal period, about the year 590, an inundation deluged Rome, and such multitudes of serpents were brought down the stream and lodged on the champaign country, as to occasion a great stench and contribute to the subsequent mortality.

Worms and myriads of flies and other noxious animals are mentioned, in the foregoing history, as the attendants on pestilence. See the years 763, 1001, 1106, 1234, 1286, 1348, 1390, 1575, 1598, 1610 and 12.

Lord Bacon informs us that during a plague in his time, there were found in the ditches and low grounds about London, a species of animals which he calls *toads*, with tails two or three inches long—a kind of animals doubtless which we often see in stagnant waters, but of larger size. He remarks further, that “those years have been noted for pestilential and unwholesome, wherein there were great numbers of frogs, flies, locusts, &c.”

Works, vol. 3. p. 166.

Aristotle mentions the multitudes of frogs in sickly years.

Prob. fec. 1.

Horstius informs us that unusual numbers of frogs, toads, locusts, serpents, canker-worms, mice, snails and similar insects, are the infallible signs of a pestilence. To these he adds an extraordinary abundance of fish in the sea and in rivers.

See p. 253, de peste.

The commencement of the present pestilential state in America was distinguished by an unusual plenty of shad, of which fourteen thousand were caught at one draft of a seine, near the harbor of New-York. I have met with one or two writers besides Horstius, who have mentioned this phenomenon, among the presages of pestilence, particularly Paracelsus in vol. 1. 168.

The plague of 1635 and 6 in Holland was accompanied or preceded by an incredible number of insects, as gnats, butterflies, beetles, wasps, grass-hoppers, but especially flies, which were so numerous, as to cover the ceilings of houses, and even to obscure the sun in the open air.

See Diemerbroeck, de peste, p. 10.

In the plague at Lausanne, in 1613, flies were in similar abundance.

Ibm.

The approach of the plague at Dantzick, in 1709, was announced by incredible numbers of spiders, in the preceding year.

Baddam's Memoirs, vol. 6. 13.

The year 1633, which produced a pestilential fever among the settlers at Plymouth in America, was remarkable for swarms of large flies, which filled the woods with their humming sounds.

In the month of August, during a dreadful drouth at Bengal in 1770, which cut short the rice-crops and produced a terrible famine, and subsequent epidemic fever, the air was filled with a

cloud of insects, of the size of a horse-flinger, with a long red body and large head ; they continued to obscure the sun for some days, during which all toads, frogs and insects on the earth disappeared, but this cloud in the air did not descend to the earth. The next year, a million of people perished with epidemic diseases.

The present pestilential period in America was introduced by such multitudes of canker-worms and palmer-worms, as were never before known. Musquitoes have been the harbingers and attendants on the diseases in New-York and Philadelphia in 1793, 1795 and 1798. In this latter year, the whole country has been overspread with grass-hoppers, which very much injured the meadows, pastures and gardens.

On these facts I will just remark, that they serve to confirm the historical truth of the scriptures. The whole series of facts, relative to the great plagues that have afflicted mankind, is a tissue of proofs, that the history of the ten plagues of Egypt was written on the spot, and is a faithful record of facts. If the operations of nature are uniform, the scriptures cannot be a spurious production. They describe Egypt and Syria, as to every thing respecting climate and productions, precisely as they are at this day ; and this fact is alone sufficient to establish their authenticity, against all the infidels on earth.

It may be impossible to define precisely those qualities of air and water which favor the production of unusual multitudes of any particular sort of insects. It has been customary for writers to ascribe them to *putrefaction* in the air ; an indefinite and unintelligible term. It is true that musquitoes and some other insects are generated in hot, moist, stagnant air, and in marshy places, when the putrefaction of vegetable and animal substances, is uncommonly rapid. But they are produced in pure water, also, without any apparent mixture of vegetable matter, beyond what is common to all water.

Flies, on the contrary, are most numerous in a hot and dry season. Moisture is hostile to their existence ; and in the year 1795, when the rainy season commenced about the 20th of July, preceding the fever in New-York, the flies almost wholly disappeared, and were succeeded by musquitoes. Putrid substances



are the food of flies, but the seasons most favorable to putrefaction, do not always produce flies in the greatest numbers.

In short, it is not possible to account for the myriads of insects which appear in particular years, on any known principles of the animal economy, or any visible properties of air and water. If unusual numbers of a particular insect appear periodicaly, as in case of the canker-worms, tho I have not satisfactory evidence of the regularity of *their* appearance, in uniform periods, we should naturally conclude such animals to pass through other forms of existence, and to re-appear in a particular noxious form, at the end of definite intervals of time. But were this the fact, it would still remain a problem of a most embarrassing difficulty, to discover the reason of their appearance in unhealthy periods only. For such is the fact, with most of the insects, and their transmigration, if admitted, will not in the least help us to account for their existence, in those times only when the state of the air is unfriendly to human life.

But in truth, as to most of the noxious insects which mark periods of epidemic diseases, we know them not to change their forms of existence, nor are the times of their appearance, periodical. On the other hand, we observe they appear in sickly periods; and in unusual numbers, at no other time. We conclude therefore that a state of the elements, unfriendly to the health of man, is favorable to the generation of noxious insects, but without attempting to explain the particular properties of the elements, which possess that prolific power.\* All I contend for, by these facts, is, that the pestilential principle, whatever may be its nature or properties is a *general* principle, affecting all the elements of life, and that to this general cause are we to ascribe the deleterious diseases which, at times, spread over extensive regions of the earth. Under this just and philosophical view of the subject, infection sinks to a very trifling consideration, among the causes of epidemic distempers.

The order in which insects and diseases appear, is not uniform; but it usually happens that the insects are the first in order of time. This was the fact in 1770, when the flies clouded the heavens in

\* May it not be the effect of excitement, owing to unusual electrical stimulus?

Bengal, and the worms darkened the earth in America. Such was the fact in 1791 when canker-worms in June gave to our orchards the aspect of winter. But the whole progress of epidemics is more or less marked by noxious and troublesome insects.

In 1798 and 1799, the meadows in some parts of Connecticut have been almost covered with small toads, of the size of a chestnut, and as described by Fernelius, "*coloris cineritii*," of the color of ashes. These animals, in such numbers, are unusual—they are not of the color of the common toad, and never grow to the same size. They come suddenly and in a few weeks disappear! Who knows their origin or their end? Fernelius numbered them, more than two centuries ago, among the prefiges of pestilence, and we are witnesses to the truth of his observation.

If we attend to the state of a pestilential air, in respect to its effects on inanimate objects, we are furnished with further proofs, that epidemic diseases are the production, not of fomites from the sick, but of a general deleterious principle.

A remarkable instance of the corrupt or defective state of air, happened in the mortal plague of the year 252. See the description of it under that year. It covered objects with what the historian calls "*ros tabidus*," a putrid corrupt dew or mould. A state of air so extremely imperfect must have been utterly insufficient to support healthy life, in the animal system.

The air of New-York in 1795 produced astonishing effects in the generation of mould, and the rapidity in the process of putrefaction, in flesh and vegetables, was almost incredible.

The fatal angina maligna among cattle in 1682 was attended with a blue mist or dew on the herbage of pastures. See the description of it under that year.

It is not an unfrequent thing that a visible and offensive mist or fog arises in places, during the rage of pestilential diseases. Such a mist arose and spread over Dantzick, in August 1709, during the plague. This fog was so thick as to darken the air, for some time, and had a very offensive smell.

*Baddam's Mem. vol. 6. 14.*

Schreibner, cited by Van Swieten, Vol. 16. mentions that a small cloud often hangs over the infected place. It is suggested

by that able author, that the contagion, collected into such a cloud, may be dispersed by winds, and afterwards collect at a different place. It is however more probable, that such collections of impure vapor, are produced where they exist; and that, if once dispersed, the particles are not afterwards collected. The phenomenon however is no inconsiderable evidence, that a pestilential state of the atmosphere, is caused or increased by vapors exhaled from the bowels of the earth.

In the mortal pestilence at Rome A. U. C. 576, Livy mentions a bow extended over the temple of Saturn, three mock-funs, and in the evening following, many transient meteors.

Lib. 41. 21.

A similar fog or vapor during easterly winds, appeared in New-York, in September 1798, in the most fatal period of the plague. Persons who felt and saw it, describe it as most disagreeable to the senses; and its effects were very remarkable. The pavements of the streets and other objects were covered with a coat of dew or mould, not however exactly resembling either of those substances; not unlike perhaps the "*ros tabidus*," or "*ros fanei similis*," of the year 252. Its effects were equally wonderful on the leaves of trees, which were covered with spots, which appeared as if corroded by an acid. And I have seen a cotton garment, which had been washed, and hung out on the night of the fog, which was also covered with spots of a dark, grey color, and which could not be taken out by any process of washing. During this period also, iron railings and pump-handles were suddenly covered over with scales of rust, or a ferruginous color. These phenomena correspond with the effects of the pestilential air at Oczakow in 1739, in which surgical instruments became livid or black, as did the silver hilt of a sword.

These recent facts which have come under my own observation, have enabled me to give due credit to historians, who mention spots in garments, appearing suddenly, during the plague. The writers who mention this phenomenon were mostly monks or other ecclesiastics, whose relations are highly tinged with superstition; and as their imaginations have usually wrought up these appearances into the figure of a cross, or other chimerical

form, and ascribed to them some miraculous qualities, I had passed over the passages with very slight consideration.

I have however transcribed or rather abridged one of these accounts, under the head of plagues in the reign of Justinian. It is from Warnefred, who relates that in the pestilence at Liguria, the Genoese territory, there appeared suddenly "*quædam signacula*," certain signs or spots, on doors of houses, garments and utensils which could not be washed out, but grew brighter by washing. See the account in the foregoing history, under the description of the plagues between 542 and 600. I recollect reading several other accounts of similar phenomena, which, for the reasons just assigned, I neglected to transcribe when the authors were before me, which I now regret.

The celebrated Boyle mentions similar phenomena during pestilence, and particularly an instance in Naples in the year 1660, which happened after an eruption of Vesuvius, and which he ascribes to a vapor. The vapor, he remarks, made impressions of curious figures on garments; and he cites Thuanus and Kircher, as authorities for his opinion. See vol. 5. p. 60.

In the dreadful plague of 746, similar figures appeared on the garments of people, which the writer calls *cruciculæ*, little crosses, which seemed as if drawn in oil. These marks excited no small terror, wherever they appeared.

Paulus Diaconus, Aug. History, p. 1012.

Similar figures were impressed on the bodies of the men who were employed by Julian to rebuild Jerusalem in 362 or 3, and who were driven from their work by earthquakes and eruptions of fire. From these facts we may be led to ascribe the formation of such spots to some electrical process, or combination with an acid.

These phenomena indicate a peculiar state of the air, which is not common even during pestilence. It is a state which marks the highest degree of derangement in its ordinary healthful qualities, and such, as blessed be God, does not often occur.

Another strong proof of the doctrine here maintained of a pestilential principle in the elements, is the well known fact, that during the plague, fowls abandon the atmosphere of the infected places.



Livy mentions that in the terrible plague in Rome, anno urbis conditæ 571, not a vulture was to be seen for two years.

Dr. Gottwald remarks that in the Dantzick plague of 1709, sparrows, daws, storks and swallows deserted the place for four months. Dr. Schelwig has recorded a similar fact; and Sorbait affirms that birds deserted Vienna during the plague. Those kept in cages died.

Diemerbroeck has informed us that in the Holland plague of 1635 and 6 birds were unusually rare. He remarks that birds more readily perceive the poisonous state of the air, and change their residence to places more salubrious, even abandoning their nests and their young. The same fact has been observed by many medical and historical writers.

The ancient physician and compiler of medical science, Ætius, mentions, among the signs of approaching pestilence, the death of birds and quadrupeds. If, says he, the circumambient air is the cause of the disease, it will first show its effects in destroying birds; if vitious exhalations from the earth, are the cause, quadrupeds will be first affected.

The fact goes to demonstrate that the pestilential principle pervades the aerial fluid and is offensive to the delicate organs of fowls. It may be further mentioned, that the deleterious principle is often fatal to small birds in cages, before it is perceived by the human race. It is a curious and well authenticated fact, that in the progress of a plague, in cities, small birds sicken and die; and not long after, the people in the same house, are seized with the pestilence. Diemerbroeck was frequently an eye-witness to the fact, and he observed, that wherever the small birds died in cages, the plague never failed, sometime after and often in two or three days, to attack the inhabitants of the dwelling. This is another proof amounting to demonstration, that the pestilential principle is a quality of the atmosphere, and that it is *progressive in its malignity*, having little or no dependence on the powers of contagion.

See Diem. de peste, p. 11.

After all, the cause of violent and destructive epidemic diseases may remain a secret. We see the causes of the ordinary diseases of the seasons, in marshes, stagnant waters, confined air, and the like; but it often happens that pestilence commits most

cruel ravages, in seasons apparently the most temperate, and in places evidently the most salubrious.

The plague in 542, and in subsequent periods of the fifty years plague of Evagrius, ascended to the tops of the hills and mountains. The terrible plague of 252, in the reign of Gal-  
 ius and Volusian, invaded every village and almost every house. The deadly plague of 1348 penetrated likewise to the most healthy spots on the globe and even to the regions of Greenland, sweeping away the human race, with undistinguishing severity.

Hildanus informs us that in the plague of Laufanne, in 1613, the huts of the peasants on the hills and mountains were not exempt from the malady, tho detached and having no intercourse with the infected. The same fact is recorded of the plague in 1720, which extended to the villages and mountains of Provence.

In the *Traité de la peste*, p. 29, it is asserted that in the melancholy plague at Lyons in 1628, the filthiest houses, the crowded places, narrow streets and confined apartments, were places of the most safety; while the most airy situations, as houses on hills, were most exposed to the ravages of the disorder. No place was exempt—the change of air was useless or pernicious; in some cases, those who enjoyed health in the impure air of the city, on removing into the country, were attacked with the malady. Malouin declares that the most populous and dirty places in Lyons and Marseilles were least affected with the plague.

These facts are very singular; yet it is not difficult to account for them, on the principle of a superabundance of oxygen, stimulus, or principle of life in the atmosphere. If, as is supposed, a usual cause of pestilential disorders, is a too great quantity of oxygen in the air, producing first the stenic or inflammatory diathesis, and of course indirect debility, then those places must be most healthy, in such a general state of the air, where there is the smallest proportion of oxygen. This remark however is a mere conjecture; and the facts related of the plague in Lyons stand as an exception to a very general rule, that the most filthy, unventilated places suffer most severely by all kinds of pestilential maladies.\*

\* In Lyons, tanners and curriers escaped the plague, as did those

It is also true in general, that the poor, who inhabit narrow streets and alleys, amidst filthy substances, suffer more by malignant complaints than the rich, who live in wider streets, and more airy, cleanly houses. To this however history presents us some exceptions; cases have occurred in which the rich have been the principal sufferers, as in 1361.

While it may be difficult to assign precise reasons for such differences in the operation of the principle of destruction, the facts prove that this principle consists in some hidden qualities of the elements, and does not arise from any of the ordinary visible causes of disease. Riverius is explicit on this point. He avers that pestilential diseases often occur, without any apparent change in the visible qualities of the air, and when the air *appears* to be more pure than at other times, when no such diseases prevail.

Lib. 17.

Further, altho it is generally true that pestilence is attended and greatly augmented in violence by some peculiarity in the seasons, as excessive heat and moisture or drouth, yet to this there are frequent exceptions. The reader may turn back to an instance of this, recorded by Livy and other Latin historians, in which it was remarked as a matter of surprise, that a violent plague, and one of the most destructive kind, should assail the city of Rome, in a mild, temperate season. A similar observation was made respecting the plague in Paris in 1580. The summer was temperate and the fruits good. No visible cause could be assigned for the malady. Yet a most certain, or rather an infallible symptom of a deranged state of the elements, had occurred in that year; I mean a most severe universal influenza. Hence it appears, that altho peculiar seasons may prodigiously increase, and perhaps produce a pestilence; yet the general cause is often some principle which has no dependence on season or changes of weather. In the last London plague, in 1665, says Hodge, the season was mild, the heat moderate, and fruits abundant and good.

who cleansed sewers and privies. The same has generally been the case with the sextons, and others employed in burying the dead. See Lancicius page 160. In London, shipwrights who labored in the vapor of tar and pitch, escaped.

We have, in America, proofs of the truth of this doctrine. The last pestilential period commenced with the measles in 1789 and severe epidemic influenza in 1789 and 90; and has already continued ten years. Some of the summers, during this period, have been very temperate, as those of 1794 and 1797. Yet every summer has produced the pestilential fever of our climate; and even our winters have exhibited symptoms of the diseases which prevail in summer. Not one year, even the most temperate, of the whole period, has failed to show the predominant diathesis of the pestilence. The sultry dry summers of 1793 and 98, and the sultry humid summer of 1795, have rendered the diseases more violent and fatal in the northern states.

Yet in the more favorable seasons of 1794, 96 and 97, the morbid cause produced its effects in New-Haven, Providence, Newburyport and Boston, as well as in Baltimore, Norfolk and Charleston.

Hence we observe that the elemental cause of the diseases of this period, may be, in some degree, modified, but not controlled or subdued by the most temperate and favorable seasons.

Indeed all writers of reputation on this subject agree, in this one opinion, that the plague cannot be ascribed, either to intemperate seasons, or to putrefaction, or to any species of exhalations from animal and vegetable substances. These are allowed to be secondary causes, operating to modify or vary the operation of the primary cause; but one uniform series of observations from the beginning of history to this day, has driven medical writers from the defenceless ground of intemperate weather, and putrid exhalations.

Hippocrates learnt that pestilence could not be ascribed solely to visible causes; he therefore admits *to theion*, something divine, or beyond human investigation, to be a primary cause of this calamity.

Tacitus informs us that the plague in the time of Nero could not be ascribed to any visible intemperature in the seasons.

Fernelius observes that altho immoderate heat augments the plague and every acute disease, yet he had known an excessively hot season, pass off without producing pestilential diseases. He



agrees with Diemerbroeck, that the cause must be some unknown principle, "*inquinamentum e cœlo demissum*," some cause of corruption in the atmosphere, which is infused into it from the celestial regions. This is cutting the gordian knot. These authors are doubtless right, in rejecting the visible qualities of the air, exhalations and intemperate seasons, as the primary causes of the plague; but they fly from earth into the boundless regions of space, for a cause which is more probably beneath their feet, or around their bodies.

Sennertus decides also most positively against putridity or corruption of the humors, as the cause of pestilence; and maintains that it proceeds from an occult malignity in the air.

Skenkius contends that persons do not receive the plague from humors in the body, from extraordinary seasons, from intestine putridity, or corruption of indigested substances, nor from bad food or drink, nor from stagnant waters, nor from exhalations from dead bodies, cemeteries or sewers, or the fetid waters of tan-yards; unless they inhale the noxious or infecting cause, *e sublimi*. To produce the malady, requires no corruption of the manifest qualities of the air.

Page 764.

Prosper Alpinus, who lived some time in Egypt and had an opportunity to make personal observations on the diseases of that country, maintains that the plague rarely arises from corrupt air, and never, unless when the Nile has exceeded its usual limits in its inundations. If, says this writer, the disease proceeded from noxious exhalations from putrid stagnant waters and marshes, it would occur every year, which is contrary to fact. Hence he concludes the disease to be usually imported into Egypt from Greece, Syria and Barbary. In this opinion, he has been followed by a whole tribe of unobserving travellers; who stupidly forget that by tracing the distemper from Egypt to Syria or Barbary, they never come nearer to its source. The question still occurs, what is its cause? where is its source? If putrid exhalations in Egypt will not produce the plague, will such exhalations in Syria or Barbary produce it? Why trace it to these countries? Does any cause exist in Syria, Greece or Barbary to generate that disease, which does not exist in Egypt?

To avoid this dilemma, some writers insist that its source is in Constantinople, where the seeds of it are treasured up in old clothes, and preserved from year to year, and from age to age. But why suppose this source of the disease to exist in Constantinople only? Why not the same source forever exist in Egypt, for there also infected clothes are never purified. In short, from Prosper Alpinus to Mead and Cullen, all the reasonings and assertions of authors on the origin of the plague, argue either impotence of mind, want of observation or extreme prejudice.

So far as this, Alpinus is right, that exhalations alone from stagnant waters and marshes will not ordinarily generate the plague; but aided by some general primary cause in the elements, such exhalations do produce the plague, and in no country more frequently than in Egypt.

Gibbon alleges this disease to proceed from hot, damp, stagnant air, drawing this conclusion probably from the origination of the terrible plague of 542, in the foul regions near Pelusium in Egypt, and in the vicinity of a large marsh. But if this were the only cause necessary to produce the disorder, as Alpinus justly observes, it would occur regularly every year, for every hot season generates putrid exhalations in ample abundance, and in every hot climate, will be found annual returns of hot, damp, stagnant air. The causes therefore assigned by Gibbon are inadequate to the effect.

In America, beyond almost any other country, we have the most irresistible arguments against this opinion. No country on earth, not excepting the rice plantations on the river Bengal, presents such an immense region of stagnant waters, and fetid marshes, as the eastern shore of the United States, from the Delaware to Florida. The southern extremity of this region is in a climate always warm; and the whole of it is exposed to burning heat, for four months in the year. Yet the true, "*pestis inguinaria*," of the oriental countries has never appeared in this country, as an epidemic; and the species of the plague which occurs, and which I call *bilious* or *American*, appears as rarely amidst the marshes of Carolina, as in the northern cities, which are exposed to no marsh exhalations.

Now if hot, damp, stagnant air, and putrid exhalations alone were adequate to the production of this bilious plague, it must be produced every year, in a multitude of places on the American coast; whereas in fact, that disease rarely occurs, as an epidemic, even on the flat lands of Carolina and Georgia; and never is very extensively mortal, except when the northern states, which are situated on high, rocky, gravelly and dry lands, and whose air and water are of the most pure and salubrious kind, are afflicted also with malignant epidemic distempers.

This is a remarkable fact and one on which I will venture to rest the whole argument. In no instance, has the city of Charleston, situated on an immense flat, surrounded by the marshes of Ashley and Cooper rivers, been severely troubled with a contagious bilious epidemic, except when the seasons have been sickly in the northern states. Witness the years 1699, 1728, 1732, 1739, 1745, 1748, 1796. I speak not of sporadic cases among strangers that visit the southern states, for these may occur every year.

The Europeans might, had they not been blinded by the false notions of contagion, long ago have discovered the same important truth; for what is called a great plague in Egypt or Syria, never occurs, except during the prevalence of malignant epidemics all over Europe, even to the Baltic. Lighter epidemics occur in Egypt and Constantinople, in any uncommon season; and so does the ordinary autumnal bilious fever, in all our southern states. These are disorders which may be excited, in any place and any season, by the action of heat on vegetable substances in stagnant water, or by the local impurities which always exist in populous cities. But these ordinary diseases do not put on the malignant symptoms which characterize the distempers of pestilential periods—they do not exhibit infection. On the other hand, when the diseases of Egypt assume contagious and deadly symptoms and spread desolation over that country, we shall always find the northern parts of Europe, more or less afflicted with the same or other malignant disorders. The pestilential principle, in greater or less degrees of violence, extends over the whole European world, and not unfrequently over the American continent.

Thus, altho the plague does not, in modern times, appear in the north of Europe, at least not often, yet all the great plagues in the Levant are visible, if I may indulge the expression, in the augmented bills of mortality in London, Amsterdam, and the Baltic cities. Witness the pestilential periods of 1720, of 1736 to 1740, of 1760 to 1763. Even the less violent pestilences of 1772 and 3, and of 1784 to 1786, have been marked by epidemics in England and Scotland. And, in the last series of epidemics, the years 1792, 93 and 95, which have been distinguished for the plague in the east, as well as anginas and plague in America, exhibit a considerable increase of mortality in London.

All these facts serve as evidence of the truth of what the medical writers of the fifteenth, sixteenth and seventeenth centuries have unanimously advanced, that the primary cause of pestilence is some invisible quality in the elements, altogether distinct from corrupt air, or marsh exhalations.

It is a remark of the Arabian physicians, that an indisposition of the air is necessary, in the hottest climates, to enforce the action of putrid effluvia on the human body to produce the plague.

Mead, 248.

Dr. Mead himself, while he maintains that the putrefaction of animal substances, with unseasonable moistures, heats and want of winds, produces the plague, and while he contends that no kind of putrefaction in European countries, is ever heightened to a degree capable of producing the true plague, admits that a corrupted state of air is necessary to give the contagious atoms their full force, otherwise the plague could never cease, but with the extinction of mankind. That is, he holds the plague never to appear in European northern countries, without contagion, but that the contagion would remain inert, without a corrupt state of the atmosphere.

The absurd opinion, that northern climates will not generate the state of air which occasions a pestilence, but that a pestilential germ, or leaven, must be imported from Egypt or other southern latitude, has been adopted by most of the British medical writers, and by a numerous part of the physicians in the



United States. It is hard to say whether the followers of Mead are the more servile, or their opinion, the more unphilosophical. But for my present purpose, it is sufficient that even the advocates for the propagation of the plague by a specific contagion, admit that this cause is not adequate to the effect, and that they are compelled to summon to their aid a general principle of corruption in the air, to account for its propagation in northern climates. This concession of the existence of such a principle, by whatever name it may be called, is all I ask.

It is on this principle only, we can reconcile the differing accounts of authors, in regard to the effect of putrefying bodies after battles, in producing pestilential diseases; some alleging that such corrupting bodies will produce the plague, and others denying the fact. Julius Alexandrinus, Diodorus Siculus and other authors, relate that plagues have arisen from the putrefaction of dead bodies after battles. Three or four instances occur in the foregoing history, of plagues ascribed to the putrefaction of dead locusts. Forestus relates that a dead whale, cast upon the shore of Holland, occasioned an extensive pestilence in Egmont. See Hieronymus, Agustinus, Sabellicus, Walsius, Angelus, Paræus, and Agricola, who have recorded similar facts, as cited by Diemerbroeck *de peste*.

Dr. Gottwald relates that the plague which spread over the north of Europe from 1702 to 1711, originated near Pickzow, soon after the unfortunate battle between the Saxons and Swedes; but he says nothing of putrefying bodies, nor does he ascribe the disease to that cause.

Baddam's Mem. 6. 5.

At the same time, it is equally true, that thousands of dead bodies after battles have perished unburied, without producing any such effect. In 1642, eight thousand dead soldiers and innumerable carcases of horses, after a battle in the Duchy of Joliers, were left to putrefy on the surface of the earth, causing an intolerable stench, but producing no pestilential disease. The same fact happened often, says Diemerbroeck, p. 31, in the cruel wars, between the Swedes and Imperialists, in his days; and we know that other historians have related similar facts.

Whenever a malignant disease follows such an extensive putrefaction, Diemerbroeck alleges, the disease to be only a pestilential fever, but not the true plague. Or if, in any instance, the true plague follows, he maintains the putrefaction to be only a secondary cause. This is probably a near approach to the truth. The whole mystery is unfolded, on my principles, which teach the existence of a disordered or pestilential state of the elements, at particular times. If the putrefaction of dead bodies takes place during these periods, when the animal functions are debilitated, or impaired, and the human body, prone to disease, the corruption of flesh may so far vitiate the atmosphere as to produce pestilence. But if thousands of dead bodies putrefy on the earth, when the air is in its natural state, salubrious and adapted to the support of health, and when the human body is in full vigor to resist the effects of the foul effluvia, it is hardly possible for any quantity of dissolving flesh to evolve a poison, adequate to the production of pestilential disorders, and certainly not sufficient to occasion an extensive epidemic.

An attention to this distinction will also reconcile all the differences of opinion, and all the contradictory phenomena which regard the effects of vegetable effluvia, and the impure air of cities.

Why, it has been triumphantly asked by the advocates of imported fomites, did not the filthy streets and putrefying vegetables of New-York and Philadelphia, produce the bilious pestilence, in former years? For many years, we recollect, more foul streets and docks, much greater accumulations of filth, yet these produced not the contagious fever which has lately desolated our cities.

Such are the facts, I admit; and the same will again take place, when the period of pestilence shall be closed, and the latent disorders of the elements, corrected. But there has existed, since 1789, a universal defect in the healthful powers of the elements, clearly evidenced by a series of severe epidemics, the influenza and scarlatina, the increased violence of the symptoms of ordinary distempers; by the imperfection of fruits; by the sickness and death of fish, fowls and cats, with many disorders among other animals. The moment this state of the elements occurs, the local impurities which always exist in cities, and which

produce only ordinary diseases, in a healthful disposition of the elements, give to those diseases new virulence and a contagious quality. The whole secret to be unfolded, is, that the autumnal diseases, under the debilitating operation of a general derangement of the elements, acquire unusually severe symptoms, a wider extension, and the quality of contagion or what I call infection. These phenomena excite the astonishment of men, who have not attended to the history of pestilence, in which they might have found the means of solving the difficulty; for similar facts have marked the progress of pestilential diseases, from the days of Moses to this hour.

I would further observe that from universal observation, it appears, that during that state of air, which produces contagious diseases in unusual numbers, all kinds of flesh and vegetables are more apt to putrefy, than in a healthy state of the atmosphere. This was observed by Diemerbroeck in the Holland plague of 1636; and we have had many proofs of it in America, within a few years past. And this is evidently true not only of fresh animal meat, but also of salted meats of all kinds. The powers of salt appear to be insufficient to preserve flesh and fish, against the strong tendency to dissolution, which seems to attend them in certain years. Hence we so frequently hear of spoiled beef and pork, and fish during sickly periods.

In some seasons, it appears to be almost impossible to keep provisions, destined for a foreign market. This effect on flesh and fish may proceed either from unusual heat and moisture in the air, or from an obvious imperfection or sickly state of the animals; and perhaps, independent of these causes, it may proceed sometimes from the same invisible principle in the properties of air, which originates new and malignant symptoms of disease in the human body; a mere excess of stimulus.

But whatever may be the cause, the effect is obvious; and the unexpected putrefaction of salted meats, has often been among the causes which have generated or augmented pestilential distempers in America. Such an instance is mentioned at New-Haven in 1794, where a quantity of putrid fish was thrown into the dock, and was excessively offensive, just before the appearance of

the pestilential fever. In New-York, the last summer, the pestilence evidently received great force and malignancy from large quantities of beef and pork which spoiled in stores and cellars. A similar cause is supposed to have excited or increased the same disease in Boston and New-London. The putrefaction of remains of great multitudes of the fish called Menhaden, on the wharves in Newburyport, in 1796, was obviously a powerful exciting cause of the disorder in that town.

In such cases, putrefaction is more rapid, and its stench more poisonous, than under a healthful constitution of the atmosphere. This accelerated dissolution of flesh is the *effect* of the common principle of disease, and in its turn, becomes the *cause* of disease.

Hence we may observe, that it is only during a sickly state of the elements, that putrefaction is ever known to excite pestilential epidemics; for almost every man has observed, many times, that the same quantities of putrefying flesh, in periods of health, produce no such distempers. It is this circumstance which has puzzled all superficial observers, and furnished the advocates of imported infection, with strong ground to maintain their errors. They allege, "the same causes have not always produced the same effects. As putrefaction and filth have not, at other times and always, produced diseases in our climate, therefore they do not produce the pestilential fever of the present time, and it *must* be occasioned by imported fomites." These men have not attended to similar facts in all other countries and in all ages. The same argument would prove that no pestilential disease can be generated any where; for it is as true of the West-Indies, of Egypt and Constantinople, as it is of the United States, that putrefaction does not, every year and at all times, produce pestilence. In this fact agree all authors who have written on the causes of the plague. And there is reason to believe, with Diemerbroeck, that putrefaction *alone* never produces the plague; but that whenever it is the *apparent exciting* cause, there concurs with it a general sickly state of the air; which not being visible, mankind ascribe the whole effect to putrefaction.

In the United States, it is a very curious fact, that this sickly state of the elements has been progressive, as I have par-



ticularly proved, in the preceding pages, which progression was clearly marked by the increase of mortality by the scarlatina, and other diseases of unusual malignity. In every instance, the epidemic pestilential fever, tho said to arise from putrid flesh, has kept pace with this insalubrious state of air. For example, while Philadelphia was ravaged by the plague in 1793, the scarlatina was prevalent in New-York; but the eastern states were exempt, and felt no inconvenience from the pestilential state of the air, unless in a few sporadic cases of autumnal fever, of augmented violence, which indicated a *commencement* of the epidemic constitution. In 1794, this constitution arrived to its *crisis* in Connecticut, moving eastward in its progress; and at New-Haven appeared the pestilential fever, soon after its precursor, the scarlatina. Now whether we suppose the pestilence to be from imported fomes, or from the putrid fish and clams in the docks, it is remarkable that it did not occur till the state of air was evidently sickly, and ill-fitted to support life, as appeared by the malignant dysentery in the vicinity, and by the universal prevalence of scarlatina. This is a curious and important fact.

Proceeding eastward we observe the same truth. The pestilential fever at Newburyport was said to be excited by the putrid garbage of fish—true, but this effect did not take place in 1793, when the fever was laying waste Philadelphia; nor in 1795, when the same fever prevailed in New-York. Why? evidently because the constitution of air in the eastern states, had not then arrived to its crisis of malignancy. But moving eastward, the scarlatina began to show itself there in 1795, and in 1796 was more general and fatal in all the adjacent country. Then followed the pestilential fever, both in Boston and Newburyport. So that if we admit the disease to be of imported origin, or suppose it to arise from putrid exhalations, we are still compelled to admit the concurrence of some general cause in the production of the disease, because we never know this pestilence to appear, but when other diseases and phenomena demonstrate the existence of such a cause.\* In Philadelphia, in New-Haven, and in almost eve-

\* If it should be said, that putrid fish might not have existed, in other years, in situations to expose the inhabitants: I answer, that with-

ry place, the pestilential fever has followed close upon the heels of that malignant distemper, the scarlet fever.

With respect to the duration of this general constitution of air, we can determin nothing, but by the event. We observe in history, that such pestilential periods are of various length, from three to fifteen years, or perhaps for a longer time; during which, diseases are multiplied and augmented; and all bearing some peculiar symptoms, that characterize that constitution or state of the elements. On this subject the treatise of Sydenham is invaluable.

There remains one other view of this subject to be considered in this section—this is, the connection of pestilential diseases with famin.

Most authors have remarked that famin is a cause of pestilence, and have cited the old Greek adage, *o loimos meta limon*, pestis post famem; the plague follows famin.

It is a just remark that the true plague often follows a dearth of provisions; it is more frequently true, that scarcity is followed by diseases of a less malignant type. But it is equally true that this order is often inverted, and famin follows pestilence. It is more frequently true that pestilence is neither preceded nor followed by any scarcity of provisions. Instances of all these facts appear in the preceding history. The conclusion is inevitable, that the plague proceeds from some other cause, than a deficient or superabundant quantity of food, for it often occurs, independent of either of these circumstances.

Thus Morellus, de feb. pest. lib. 3, relates an instance, where no pestilential diseases succeeded a severe famin. Galen mentions an instance of a severe famin which followed as severe a plague in Rome, yet the famin did not again excite the plague.

De Pauw, in his Philosophical Dissertations on the Egyptians and Chinese, vol. 1. 87, answers and refutes the Abbe Fourmont who alleged famin to be the cause of the plague.

“By exact annotations, says De Pauw, continued during in my observation, in numberless instances, immense quantities of the entrails of fish are left to putrefy on the shores of our rivers, every year, with an intolerable stench, but without producing the least appearance of disease.

twenty-eight years, we find the plague has raged in Egypt five times, without being preceded by any scarcity of food, and contrary to what I once suspected, unrestricted to a periodical course." We know also in America, that scarcity of food can have had no influence in producing the numerous epidemic and pestilential disorders of the last nine years.

On this subject Diemerbroeck has a very just remark, and one that solves all the difficulties that might seem to arise from the differing accounts of the effects of famine. He says "*Non omnem, sed illam tantam famem sequitur pestis, quæ fames et ipsa a pestilentia causa originem sumit, (dum ab ea causa primo fruges terræ corrumpuntur, postea pestis inducitur,) ita ut fames illa non sit causa pestis, sed ipsamet eandem cum peste causam habeat.*"

*De peste, page 30.*

"For the plague does not follow every famine; but that only which arises from the same cause as the plague; (for by that cause the fruits of the earth are first vitiated and afterwards the plague succeeds) so that the famine is not the *cause* of the plague, but proceeds itself from the same cause."

Whenever there exists a general cause in the elements, unfriendly to the health of the human race, and at the same time, to the growth and perfection of grain, pestilence and famine may be companions of each other; or they may reciprocally follow each other, according as the general cause operates first on vegetables or on mankind. In such cases, superficial observers are apt to suppose one to be the cause of the other, when in fact, they are both the offspring of a common cause.

In long sieges, bad food is often a powerful cause of disease, as in the siege of Marseilles by Julius Cæsar, before Christ 48. Cæsar, *De bel. civ. lib. 2. 26.* In such cases, the bad qualities of the corn or bread, are not natural defects in the growth, but the effects of age, heat, moisture and decay.

Fortunately, the improved state of agriculture has rendered a dearth of grain, a rare occurrence. In despotic governments, where industry of every kind languishes, and men seldom make provision for subsistence beyond the passing moment, famine is not unfrequent in modern times, as in Syria after the terribly severe

winter of 1756-7, when the crops failed, and parents devoured their children, or offered them for sale in market to procure food. But such is the state of agriculture, in free countries, that crops are less liable to fail, than formerly ; and when they fall short in a particular country, commerce may usually supply the deficiency from some other climate. A universal failure of grain, even under the most unfavorable disposition of the elements, must be a rare phenomenon.

Yet with all our improvements in agriculture and commerce, we are not to calculate with certainty that we are never to feel the scourge of famine. There has been, within about a century, a succession of seasons when the earth failed to yield her accustomed quantity of vegetable food. Such were the last years of the last century, when corn was cut short by mildew and blast, not in one country only, but in most countries. Multitudes perished in the north of Europe, and our forefathers in America observed, that for a number of years, the very course of nature seemed to be altered.

The beginning of the seventeenth century was distinguished by a still more extensive and severe dearth, which afflicted all Europe, and cut off a large portion of its inhabitants.

In the year 1783, the dearth in Scotland was so severe that commerce alone saved thousands from perishing ; and so late as the year 1790, our own country experienced a scarcity that excited universal alarm. Both of these periods were distinguished for severe famine in Egypt, Bengal and the Carnatic.

Such facts show us the all-powerful influence of the invisible energies of nature, and how little avail human efforts, to avoid the fatal consequences of a universal failure in their operation. That the principles of vegetation do thus fail, at certain times, over large portions of the globe, is an unquestionable truth ; it is equally certain, that such events are intimately connected with the cause of pestilence among men. Hence we observe that men and cattle often perish with epidemic diseases, when vegetables fail to yield their customary fruits.

It is not however the want of food which occasions diseases, so frequently as the bad quality of it. Next to the corrupt state



of air, says Riverius, unwholesome aliments are the causes of pestilent diseases. Vegetables may acquire unwholesome qualities from too much or too little moisture, or from other unknown causes. Grain of a good quality may also degenerate and become unwholesome, by heat and moisture, after it is gathered, as in magazines, granaries, or holds of ships. Such corn may produce diseases in those who feed upon it.

But it is doubtful whether mere want of food ever produced a contagious disease. Seamen who suffer and even perish at sea, in a wholesome air, thro mere hunger, pine away and die without disease. Whenever contagious distempers accompany dearth, there is usually a concurrence of other causes to produce the effect.

We may therefore consider the proposition of Diemerbroeck as correct, that famine does not produce the plague, but proceeds from the same cause; yet that scarcity of food and still more certainly, food of a bad quality, may produce diseases of a less malignant type, or very much augment, in violence and extent, the current disorders of a particular season.

Yet here again our senses may deceive us. Corn of an apparently bad quality, does not always generate disease. A striking instance of this is related in Sinclair's *Scotland*, vol. 7. 605. Frost, rain and snow had turned the corn black; it was disagreeable to the taste; the straw was equally affected; but neither man nor beast suffered by feeding on them—so little do we know of the cause of diseases.

Intimately connected with the subject of vegetable nutriment, is the consideration of diseases among cattle. Whenever grass is defective in wholesome, nutritious qualities, horses, horn-cattle and sheep are sure to suffer by mortal distempers.

It is often mentioned in the foregoing pages, and a fact that every man may have observed, that when contagious diseases prevail among men, similar disorders prevail more or less among cattle. Very few of the plagues in ancient Rome, affected one species of animals, without showing the pestilential principle in others. The same remark may be made, in all ages, and is true at the present period. Sometimes the pestilence invades one species of animals first—sometimes another; sometimes the diseases

will be more general and severe among men, and sometimes among cattle ; but seldom do we observe one species of animals severely affected, and the other totally exempt.

So far as my reading and observations enable me to judge, diseases among cattle usually succeed excessive or unseasonable humidity in the air. The years 1712 and 13, when a plague destroyed a vast proportion of the cattle in Italy, and great numbers in Germany, are noted in England, to have been wet and cold. What was the state of the air in the countries where the disease was most fatal, I am not informed. The short account I have seen of it, abridged from Ramazzini, in the 6th volume of Baddam's Memoirs, makes no mention of the weather or seasons ; and Lancisus, who has also left many particulars respecting it, is not before me. The disease however was a true plague, characterized with many of the symptoms of plague in the human body. Authors all agree that the distemper was propagated solely by contagion from a single cow, from Dalmatia ; and they are so well contented with this idea, that they tell us little or nothing from which we can collect the cause. Like the writers on the cause of the plague in Egypt, who trace it to Barbary or Syria, and there leave the subject ; so Lancisus and Ramazzini, tell us the distemper, which destroyed most of the cattle in Italy, came from one cow, in a drove from Dalmatia ; and there they stop short, without a syllable to explain why the cow from Dalmatia was seized.

All these contagion-sticklers resemble the Indian, who, when asked what the world stands on, replied, on an elephant—the elephant, on a great turtle, and the turtle, on the ocean. Here he stopped, and as to what supports the ocean, he leaves us in the dark.

The general visible cause of pestilential diseases among cattle, as before remarked, seems to be an excess of moisture, which renders their food watery and unsubstantial. The summer of 1751, a year of remarkable mortality among the cattle in England, was cold and rainy. Such was the season in 1348, which was followed by a great loss of sheep, as well as by pestilence among men.

Yet all wet seasons do not produce the same effect ; and we are constrained to resort, for the cause, to unseen properties in the air or the food on which the cattle subsist.—That the same general cause affects cattle and the human race, in times of pestilence, is obvious from the analogy of symptoms in their diseases. During the present sickly period in America, horses and horned cattle have died, in many parts of the country, with diseases which are characterized with bilious appearances ; in analogy with all the disorders which have affected men, during the same period.

Lancisus and Ramazzini would have treated the subject of the disease among horses and cattle in Italy, in 1712 and 13, much more like philosophers and men of sound science, if, instead of telling how much mischief an infected cow had done, and how the disease had been spread, by farriers, by dogs and by shepherds, they had described to us the seasons, the state of vegetation and the diseases which prevailed among mankind. They ought at least to have connected, with the disease among cattle, an extensive plague among men which was then raging in Vienna, Hungary, and other countries, as it had been, for several years before, over all the Polish and Baltic territories.

The frequent prevalence of mortal epidemics among the brutes, is an obvious and irresistible proof of some deleterious principle in the elements, which is adequate to the production of the worst diseases, and the destruction of life, independent of every artificial cause.

The brutes, if left to themselves, follow implicitly, a principle of their nature, called instinct. They eat what nature intended for them, and never feed on what is pernicious to their health ; nor will they injure themselves by eating too much or too little of their ordinary food. Governed by such a law, they can be liable to no diseases, but such as must necessarily proceed from the air they breathe, the water they drink, or the vegetables they eat, all of which are ordinarily good, nutritious, and well fitted to support sound health. Their diseases therefore must proceed from some imperfection in these elements of life, which is occasioned by natural causes. This process of reasoning appears to

be strictly logical and correct. The conclusions from it are inevitable. If a state of the elements does ever exist, which can produce diseases that destroy the lives of the brutes, without contagion or any artificial cause, we may safely allege that a state of the elements may exist in any latitude which is adequate to the production of the most formidable maladies, that ever affect mankind.

The analogies of the animal economy, and continual observations forbid us to suppose the powers of life in the beasts of the field, less perfect, or more easily dissolved, than those of the human race. On the contrary, from their following their natural undepraved appetites, in the use of food and in all their actions, their bodies may be supposed to be more firm and perfect than those of men, who are usually debilitated by irregularities in living, and other deviations from the laws of nature. If then irrational animals are subject to the invasions of mortal epidemic diseases, which mow them down by thousands, in defiance of the firm texture of their bodies, and their regular living, a fortiori the human race must be liable to destruction by similar means.

This reasoning is certainly just and substantial, whatever may be its fate in convincing the reader; and it proves that the natural operation of some secret principle in the elements, is sufficient to account for the most destructive maladies, in every latitude on the globe, without resorting to the transportation of fomites from some one heaven-scourged country to more favored regions.

Dr. Mead and all his servile admirers who believe him, without investigating his assertions, allege that putrefaction never rises, in England, to a degree that is necessary to generate a pestilence. But if any man can believe that putrefaction, as writers are pleased to call the principle of destruction, can rise high enough in the grades of malignity, to produce a plague or contagious mortal distemper among cattle in England, and at the same time, never affect the human species, he must have more pride in the supereminent station of man in the scale of being, than I possess. The argument from facts is evidently in favor of the theory, which subjects all animals, in this respect, to the same laws; and the



analogies of creation will not authorize man to claim the high privilege of exemption from the general laws of the animal economy.—It is an unquestionable truth, that men as well as brutes, in all latitudes, are often invaded with contagious and deadly diseases, under the operation of the elements, without the least accession of contagion from southern climates or any foreign country. Multitudes of facts warrant this deduction; but the progression in the violence of epidemic diseases, the imperfection of vegetables, the sickness and death of fish in rivers and the ocean, and of cattle on land, are proofs of the truth of my principle, which bid defiance to opposition.

## SECTION XVI.

*Of Contagion and Infection.*

**N**O point on the subject of diseases has been more agitated among medical writers, than that of the contagion of the plague, inguinal and bilious.

Hippocrates has left no decisive opinion on this question, but those who maintain the plague not to be contagious, rely on this silence of the father of medicine, as an argument in their favor.

Galen's opinion was clearly in favor of the contagiousness of certain diseases. "Quodque periculosa sit conversatio cum laborantibus pestilenti morboquum nimirum is non secus sit contagiosus, quam scabies aut lippitudo."\* p. 379. The author doubtless speaks here of other pestilent diseases, besides the inguinal plague, according to the practice of the ancients who gave the name of *pestilence* to other malignant distempers, when epidemic. His opinion however was that the plague originates in a putridity of the air, inhaled by the breath. "Lues ipsa, ab aeris putredine exorta, per inspirationes insiliens, haud unum aut alterum hominem, sed plures quoque civitates depascit, vastat, et populatur." p. 627. In another passage, he remarks, that pestilent diseases proceed from a state of the atmosphere. "Pestilentes morbi a cœli statu proficiuntur."

This author observed that pestilential epidemics must have some cause more powerful and extensive, than contagion, or infection.

Aristotle was clearly of opinion that the plague is contagious, and the reason he assigns why pestilence alone is communicated from person to person, is, that this is the only disease which is

\* In another translation, the latter part of this passage stands thus; "periculum enim est, ne concipiatur, ut scabies et lippitudo."

common to all men. This is not very clear or satisfactory ; but he speaks of fomites proceeding from the sick, and infecting others.

See Problem, sect. 1.

Procopius was not a physician, but is esteemed as a historian. He alleges that in 543, the mortal plague in Constantinople was not contagious, and that physicians and attendants on the sick, did not contract the disease.

On the other hand Thucydides, has declared unequivocally that the plague in Athens was very contagious. Evagrius also has related that the disease, in his time, was very contagious, to particular persons, while others escaped, even against their inclination. Livy also was decidedly in favor of the doctrine of contagion.

Petrus Salius Diversus, cited by Diemerbroeck, was of the opinion, that the plague is sometimes contagious ; at other times, not. Seneca held to the contagious nature of pestilence. So says Ovid, *Metamorph. 7.*

*Quo proprior quisque est, servitque fidelius ægro,  
In partem lethi citius venit.*

The nearer we approach, and the more faithfully we serve, the diseased, the sooner we fall victims to the distemper.

Those who oppose the doctrine of contagion, not only produce as authority, the silence of Hippocrates, with Avicenna, and other Arabian physicians, on the subject ; but they allege, that if the plague was a contagious disease, it would *always* infect those who have communication with the diseased. But this they aver to be contrary to fact ; and they instance the escape of many physicians, surgeons, grave-diggers, hearse-men, and others. They argue further, that as the breath and effluvia of persons in health, will not expel the poison of the plague from the diseased ; so, on the other hand, the effluvia from the infected, cannot infuse the seeds of the disorder into a healthy body.

Gregory Nyssen, a celebrated philosopher and theologian, concludes, that those who are seized with the plague, after an intercourse with the diseased, contract it from the same state of the air, which occasioned the distemper in the sick, and not from the effluvia exhaled from the infected body. While I cannot

assent to this opinion, in the utmost latitude, I firmly believe it contains a great deal of truth.

Diemerbroeck, de peste p. 44, suggests that the ancient physicians, who passed over the subject of the contagion of the plague, called that quality only *contagion*, which communicates disease by immediate contact, as in case of the itch, leprosy, hydrophobia and the like; whereas the plague infects more frequently through the medium of the air, vapors, garments and other objects. Thus the sweat, exhalations, and excrementitious matter of the sick corrupt the air, and this infected air becomes the means of disease to persons in health who breathe it. This, says Diemerbroeck, the ancients did not call contagion, proceeding from the diseased, but they considered healthy persons taking the distemper through this medium, as infected by the malignity of the air.

Almost all modern physicians however agree in the opinion that the plague is a contagious disease, as Forellus, Prosper Alpinus, Diemerbroeck, Sydenham, and a multitude of others; and on this general opinion, have been instituted quarantine laws and other regulations for preserving cities and countries from the disease. Of the value of these regulations, we shall be the better able to judge, after taking a careful survey of the question relative to the force and effects of contagion.

Within a few years, one author has ventured again to call in question the received opinions on this subject. Dr. Maclean, in a small treatise, has attempted to prove that the plague, dysentery and epidemic fevers are never propagated by contagion. Contagion he defines to be "a specific matter generated in a person affected with disease, and capable of communicating that particular disease, with or without contact, to another."

This author's general arguments are these, That specific contagion must necessarily act and communicate a disease from a sick to a well person, within a certain distance—that in the plague, dysentery and epidemic fevers, a small proportion of people, exposed to the action of effluvia from the diseased, are ever affected by the distempers, and therefore such disorders are not contagious. He considers those diseases only as contagious,



which can be received but once by the same person ; as the small-pox and measles. He affirms that the existence of contagion in plague, dysentery and fevers, has been uniformly taken for granted, not only without proof, but even contrary to the evidence of numerous and convincing facts. He lays it down as a truth, that all epidemic and pestilential diseases, which may affect a person more than once in his life, are caused by certain states or vicissitudes of the atmosphere, producing indirect debility.

The variety of opinions on this subject argues either a want of accurate observations among medical men, or of accurate distinctions in terms. The various powers of diseases to communicate themselves, either have not been understood, or they have been imperfectly defined. Let us then attend to facts, the only genuine source of knowledge.

First. We observe that the contagion of the measles and small-pox, takes effect with great certainty, whenever a person in health, who has never been affected, approaches sufficiently near to a diseased person. I do not say it *always* takes effect ; for there are a few exceptions ; but these are so rare, as not to impeach the generality of the fact, or principle.

The contagion of the plague, dysentery and violent fevers, does not, under circumstances equally favorable, take effect with the like certainty. On the contrary, a great proportion of persons exposed to the effluvia of the sick, entirely escape the distempers.

Secondly. The contagion of small-pox and measles, is not sensibly affected in its operation by heat or cold, moisture or drouth. It acts with the same certainty in winter as in summer, and in every variety of temperature.

The contagion of plague, dysentery and typhus fevers, on the other hand, depends almost entirely on heat for its activity, and is subdued, rendered inert, or totally extinguished by cold. Hence an essential difference in the two species of contagion—that of the small-pox and measles being an essential quality of the diseases ; while that of the other diseases is an accidental circumstance.

Thirdly. The contagion of the plague often discriminates between the natives of particular countries, or men of a particular blood, or family, seizing one and passing by another, and this through the whole course of an epidemic ; but the small-pox and measles make no such distinctions.

Fourthly. The contagion of the small-pox and measles is not destroyed by the purity of the atmosphere ; it acts with the same certainty on the most salubrious hills, as in the most impure recesses of poverty.

Not so the contagion of the plague, and dysentery ; for as a general rule, these diseases are not propagated in a pure atmosphere. With respect to the plague, some exceptions exist ; but it is the usual fact, that these last named diseases will not spread by contagion in a wholesome state of the air. By removing the sick, from a city into the country, or otherways placing him in an airy room, and preserving it clean, with all the apparel and utensils, the contagion is so dissipated or attenuated, as to be rendered harmless ; the attendants escape, and the disease is extinguished with the death or recovery of the patient.

Fifthly. The contagion of the small-pox and measles can never act but once on the same person. Its first operation destroys the capacity of receiving it a second time. The exceptions to this rule are too few to deserve consideration.

Totally different is the effect of the plague and dysentery, for instead of fortifying the body against a second attack, these diseases debilitate the animal powers, and render the patient more susceptible of the contagion in a subsequent year. It is admitted by all correct observers, that the plague may be received by the same person, times without limits ; a person in Constantinople died of the twelfth attack ; and many persons, in the late plagues in America, have been affected two or three times. With respect to dysentery and other contagious fevers, there is no controversy on this point.

Sixthly. The contagion of the small-pox and measles, if it takes the least effect, produces the disease complete. The infected patient may be affected more lightly than the infecting person, and the degrees of violence in the symptoms may be very

various; but the disease produced, will always be completely formed, and of the same specific type, as that from which it is communicated.

The contagion of the plague and dysentery, has not the same certainty in its effect. The contagion of the plague very often produces only a nausea and vomiting—sometimes an inferior grade of fever, as an intermitting or remitting fever, of which I have myself seen examples—very often its effects are limited to dizziness in the head, or severe pains in the glands—and sometimes it has produced external eruptions, without any other material affection; as in the celebrated Diemerbroeck, who, in the grievous plague at Nimeguen, was affected with a carbuncle on his left hand, while in good health. In 1796, I saw an instance in New-York, in which the infection of the pestilential fever had occasioned a singular swelling and inflammation in the face of a nurse, who escaped the disease.

Seventhly. We may perhaps add, what Diemerbroeck and other writers consider as essential to give effect to the contagion of the plague, and dysentery, an apt or suitable disposition in the sound body to receive the contagion. Some peculiar state of a body in health is evidently necessary to the operation of the infecting principle of the plague; this is agreed by all authors. But it does not appear that any such state or disposition is requisite to give effect to the contagion of small-pox or measles, which acts upon all bodies, within the reach of their effluvia. This consideration may be the cause of the first distinction before recited; and a few exceptions exist to the proposition in regard to the small-pox and measles, which, tho rarely, fail of operating on bodies in health.

These are important distinctions, which, had they been observed by medical writers, would have prevented the enormous errors of Mead and others, who maintain that the plague is propagated, in northern countries, by specific contagion only. The truth is, the plague is a contagious disease, like dysentery, and most typhus fevers, but the contagion is *not specific*.

Specific contagion I define to be, a quality of a disease, which, within a suitable distance, communicates it from a body affected

with it, to a sound body, with great certainty, and under all circumstances of season, weather or situation. Such is the contagion of the small-pox and measles. This contagion is of two kinds; first, that which acts by contact only, as that of the itch, leprosy, hydrophobia and syphilis; secondly, that which produces its effect, with equal certainty, by near approach, as that of small-pox and measles. The contagion of the angina maligna approaches to the specific kind; and if it is true, as some modern physicians have asserted, that persons can never be affected with it, more than once, it comes under the character of a *specific* contagion, but I doubt the fact. Several persons in Bethlem, were affected with the scarlatina anginosa twice, during the late epidemic; first in 1793 and again in 1794.

Medical Repository, vol. 1. 315.

That quality of a disease which may or may not excite it in a sound body, within a suitable distance, or by contact; and which depends on heat, foul air, an apt disposition in the receiving body, or other contingent circumstances, and which may excite the disease in the same person more than once, is certainly a very distinct species of contagion, from that of the small-pox, and to this I give the denomination of *infection*.

With a distinction of this sort, which seems to have been first adopted by an eminent physician in New-York, Dr. Bailey, in his treatise on the fever of 1795 page 38, and which is unquestionably well founded, we have no difficulty in explaining all the phenomena of contagion, which have given rise to disputes, without number and to the most contradictory opinions. The plague, glandular and bilious, the dysentery, typhus fevers, and the milder kinds of angina, are not *specifically contagious*, but they are *infectious*. They will not and do not propagate themselves in all situations, but the operation of the infecting quality is controlled by a multitude of contingent circumstances.

First. It is admitted on all hands, that a suitable and particular constitution of air, is necessary to render the plague epidemic in northern latitudes. Thus Sydenham supposes this disease to be conveyed by pestilential particles from one place to another, but not to become epidemic, unless favored by the constitution of



air. One ground of his opinion seems to have been a fact related by Mead, that when the disease has raged violently in one town, in the same climate, a neighboring town has totally escaped, by forbidding intercourse with the infected place, as once happened in Tuscany.—This fact will be afterwards considered.

Mead also, while he declares his opinion that the plague is spread by specific contagion only, like small-pox and measles, and that all plagues are to be traced to Egypt, very inconsistently admits that a certain corruption of the air is necessary to give the contagious atoms their full force.

These opinions are utterly incongruous; for if the plague possesses specific contagion, like the small-pox, then a corrupt state of air is *not* necessary to give full force to the contagion; for no such state of air is requisite to give force to the contagion of the small-pox. It spreads with as much certainty in pure air, as in foul air. Mead's principles therefore overthrow his own theory. But he was driven to admit some general constitution of air, to be necessary to the propagation of the plague, because he had learnt from reading that the plague will not spread in all places, at all times and under all circumstances. In truth, Mead never had an idea of the difference between the species of contagion; and the same may be said of most modern writers.\*

\* It is a most extraordinary circumstance that the British authors, in modern days, should all agree that a favorable constitution of air is necessary to propagate the plague, and yet that no plague is bred in northern climates. They must admit and do admit, that such a favorable state of air has often existed in all parts of Europe; this is a kind of half way business; allowing northern climates the power of creating and preparing a condition of atmosphere that shall meet the plague half-way.

But will it be denied that the petechial fever and angina maligna originate in northern latitudes? I presume not. Then the condition of air is admitted to produce *most deadly infectious* diseases, but not *the most deadly of all*. Kind heaven, in mercy to the northern world, has permitted the elements to generate diseases almost as bad as the plague, but not quite.

I then ask, does not the production of the angina maligna suppose as deleterious a principle in the air, as that of the plague? Is not the disease as fatal to youth, and more certainly infectious or contagious? This cannot be denied. That disease sometimes destroys as great a proportion of patients seized as the plague, and is more certainly contagious to youth? Besides this distemper depends not on local causes, but wholly on a condition of the elements; it therefore implies a most essential alteration in the atmosphere.

Sanctorius, cited by Van Swieten, remarked that the rays of the plague may be removed by the wind, yet he was surprised to observe that these rays from the body of a diseased person, are never disturbed by the force of the air. I do not perfectly reconcile these remarks ; but it is an indubitable fact, that a pestilential state of air, when clearly and distinctly formed in a city, is not dissipated, nor very greatly affected by the most violent winds. It has sometimes been remarked, that the pestilential fever in American cities, has been spread by particular winds ; but it has spread not only before, but against the wind, tho perhaps with less rapidity. Certain it is, that no force of wind whatever ever expels from a town, or lessens the pestilential virus without the aid of other causes. Of this we have had repeated proofs in America.

Perhaps we may explain this fact, and reconcile the observations of Sanctorius, on the principle I have unfolded ; by supposing the effluvia of the sick to be, in some degree, capable of dissipation by the wind, which is undoubtedly true ; but that the elemental cause of pestilence, which consists in the essential properties of the atmosphere, is not subject to dispersion or removal by the winds. This consideration would involve a curious question, viz. whether, in the apparent motion of air, called wind, the whole mass of the surrounding atmosphere is moved, or whether it is the vapor, or other component parts of the air only, which are moved, while the fire or electric fluid remains stationary. But whatever may be the cause, the fact is certain, that the pestilential principle, during a plague in a city or town, is never expelled by winds. A most violent, cool north-west wind swept the city of New-York, on the 19th and 20th of September 1795, without any considerable abatement of the pestilential fever. This fact adds no small weight to my opinion, that the primary cause

Further, if petechial fever is generated in northern climates, it demonstrates the power of those climates to produce the plague ; for it has been proved, that this fever is the same species of disease, and often turns to the plague. It has done this, very often in England and on the Baltic.

Infection spreads certain diseases, and ought to be avoided ; but medical men have ascribed ten times more effects to that cause, than it ever produced. The same principle which generates the angina maligna or plague, in one instance, must be competent to produce it in all other persons of like disposition and habits.

of such diseases, is in the essential combination of the component parts of the atmosphere.\*

Sanctorius further observes that "things infected with the plague, communicate the disease, as long as the proximate and remote causes subsist; one of which ceasing, the infection ceases." This is an explicit acknowledgment that the contagion is not *specific*, but dependent on some other cause, agreeable to the doctrine of Sydenham.

This principle is verified most remarkably in Egypt, as appears by all the authors who have written on the subject. They are all constrained to admit, even when they allege the plague to be not native in that country, that, if imported at certain seasons of the year, it will not spread. Prosper Alpinus expressly declares that the plague is *never imported in the months of June, July and August*; "*nunquam visa est pestis illuc ex infectis locis profecta*;" altho he maintains that the disease is almost always imported.

This is certainly a most extraordinary assertion, and unworthy of the reputation of the writer. What in the name of sense and consistency, should prevent the seeds of such a disease from being "imported" in a particular season, when vessels are passing continually between that country and infected places? The idea betrays extreme weakness or prejudice.

Savary in his letters on Egypt has detailed the true state of facts. He saw vessels, which arrived in Egypt from Turkey, in the month of August, and landed their infected goods and people, without communicating the disease. He informs us, that it is an observation of ages, that infected merchandize brot into Egypt, in the months of June, July and August, do not excite the plague, but the disease expires of itself. If introduced at

\* Warm southerly rains however high the wind, usually increase the violence of the disease, by inducing debility and giving activity to the local causes, as noxious effluvia from vegetable substances. Cool northerly winds, accompanied with heavy rains, lessen the morbid action of the pestilential principle; and if late in the season, and not succeeded by very warm weather, may entirely remove it. A violent tornado, with great rain, on the 8th of October 1797, was supposed to put a stop to the pestilential fever in Providence. Water decomposes the poison, or incorporates it into its own mass—but heat after moisture occasions a more rapid decomposition of vegetables and increases the poison,

other seasons, and communicated, it ceases ; but if imported in winter, it spreads.

The author has here stated effects or phenomena, with a good degree of accuracy ; but has entirely mistaken the cause. It is wholly the state of air, in different seasons, and not infection, which occasions these varieties.

Mackenzie, in an account of the plague in Constantinople, tho a firm believer in its contagion, declares " that both in that city and in Smyrna, the plague breaks out in some years, when it is not possible to trace whence it is conveyed." This is doubtless true ; yet neither this fact, nor the known fact that contagion in Egypt will not operate in a certain season of the year, has ever opened the eyes of European authors to the absurdity of the current notions about the specific contagion of the disease.

A fact related by Patrick Ruffel, in his history of the plague at Aleppo in 1760, is full to the same point, that the contagion of the plague, will not take effect, without the aid of other causes. In 1759, the disease was introduced into Leinsol, a port on the south side of Cyprus, where it spread. Larnica, a town forty miles distant, received part of the infected crew, which brot the contagion to Leinsol. A constant communication was held between the two cities ; peasants and mule drivers entered Larnica, with their pestilential sores upon them, and were daily in the streets and markets. Some died in the houses of the inhabitants. Other vessels also arrived with infected crews from Egypt, some of whom died on landing. Yet mark the issue—all this contagion did not excite the plague in Larnica ! But in the beginning of the next year, eight months after, the disease appeared in Larnica, without contagion, and made great havoc. See Ruffel, page 4.

This fact and others compelled the author to admit that the disease is not always contagious, and that it does not become epidemic, without a certain state of air. See pages 4, 5, 7, 17, 19, 307. These facts are of infinite consequence in directing the application of laws of quarantine ; a subject to be hereafter discussed.



Innumerable examples may be produced of plague, appearing in a few detached cases, without becoming epidemic and without extending itself by contagion beyond a single family. Often it appears in sporadic cases, without exhibiting any contagion.

Follinus relates an instance of a family, in which the father, mother, with two children and a servant died of the plague, without glandular swellings, and without spreading the disease beyond that family.

Joubert informs us of an instance in 1574, of a respectable family, which lost half of its members, by the plague, which ceased without spreading the infection. This was at the commencement of a most pestilential period.

Matthias Untzerus relates, that at Halle in Saxony, he was an eye-witness of instances, in which here and there a family had been seized with the plague, introduced from other places, without any ill effects in the rest of the city—the disease terminating in these families.

Diemerbroeck observed similar facts. In Oct. 1661, the daughter of a noble widow, was seized with a violent disease resembling the plague, in the midst of a town where no plague existed, and no foreign cause could be assigned for the disease. The servant, who attended her, died, and the infection extended to seven persons, in succession; the rest saved themselves by flight. These persons died, without the glandular tumors, and of course some of the attending physicians, denied the disease to be the plague. Diemerbroeck, on the contrary, judging from all the symptoms, pronounced it the plague. It happened that one of the maid-servants, who left the family and was going to her brother's at Amsterdam, was infected and seized with the plague, which soon put on the genuine marks of the disease, in an inguinal tumor and two anthraxes. She recovered, but infected two of her brother's children, and there the disease disappeared. No local cause could be assigned for the disease in that family. The plague was not before in the city or country, the house was a splendid, elegant one and kept remarkably clean, remote from any filthy place, and had never been known to have an infected person in it. Hence our author concludes very justly that a pestilent dis-

dise is not always epidemic, nor is an epidemic always dangerous, nor is pestilence necessarily common to many people; but that the spreading of a disease by contagion, is wholly an accidental circumstance.

See p. 13, 14, of *Diemerbroeck de peste*.

On this last fact, I will only observe, that the year it happened, was 1661, the beginning of the constitution which produced the augmented violence of the diseases of London, as related by Sydenham, and the constitution which occasioned the plague in Holland in 1663 and 4, and that in London in 1665.

It is to be regretted that those able physicians and accurate observers had not extended their views of the subject to a prevalence of that pestilential constitution, in various countries, at one and the same time, instead of restricting their observations, each to his own country.

The author of the *Traité de la peste*, who was a warm stickler for the origin of the plague at Marfeilles in 1720 from importation, and wrote a treatise to prove it, has however demonstrated the contrary. He has admitted that the air of Marfeilles was pestilential and produced diseases marked with buboes and carbuncles, in the autumn preceding its supposed importation. But this is not all; he has recorded facts which confirm all that has been cited from Alpinus, Savary, Ruffel and others, that the contagion of the plague will not spread the disease in an atmosphere not favorable to its propagation. He informs us, that the disease spread from Marfeilles, in spite of all precautions, and infected more than fifty villages of Provence. This was ascribed to infected goods conveyed from Marfeilles. Yet the surrounding provinces of Languedoc, Velais, Dauphiné and others, which he acknowledges to have been inundated with goods from the same city, escaped all infection. In Provence, the distemper reached the inhabitants of mountains and was not even arrested by the rigors of winter; while in the adjoining territories, no person was affected, tho equally exposed to infection. The author remarks further, that the disease passed over some villages, and infected others beyond them; for which no reason could be assigned, while all were alike exposed.

These facts were very surprising and unaccountable to the author, Chicoyneau ; yet there is no difficulty in explaining them, on the principle for which I contend ; that the propagation of the disease depends entirely on a favorable state of the atmosphere, and not the least on contagion.

Almost all the supposed instances of infection from merchandize, related in authors, when investigated, are found to be mere suppositions and conjectures, raised and spread by vulgar credulity, without the least foundation, and afterwards recorded as facts, by medical writers, who are infinitely less excusable, than other people. I have investigated many such instances in America, where reports had become popular, and grown into such credit, as to be generally believed and received as facts, and I have, in every case, found evidence amounting to demonstration, that those reports were idle surmises, very often puerile in their origin, and utterly unsupported by facts. Some of the received opinions, in regard to the imported infection of plagues in Europe, when subjected to careful scrutiny, prove to be equally destitute of foundation. Among these, are the opinions, received and recorded by grave writers, relative to the London plague of 1665, and that at Marseilles in 1720.

The supposition that the plague was conveyed from Marseilles into fifty villages of Provence, by means of merchandize, appears to be no better founded. Setting aside the errors of vulgar tales, in which such opinions usually originate, it is utterly against all probability that goods sold from shops and warehouses should contain infection. If they are ever infected, it must be by being used by the sick ; but the sick do not use the goods in shops and stores ; they are confined to their rooms ; and rarely indeed are their bedding and clothes, sent to market. Goods, the most susceptible of infection, as woollen and cotton, may lie in store during the plague, without any taint that can excite disease. In America we know this to be fact. In every town, where the fever has prevailed, shops and warehouses filled with such sorts of goods, are open long after the disease has appeared, and until the air of the streets has become so pestilential, as to excite the disease in a few hours in healthy strangers ; nay,

some of these shops are open, during the whole time, of the rage of our worst plagues; yet even cotton and woollen cloths have never, in any instance, contracted infection so as to communicate the disease afterwards to those who handled or used them. I will venture to aver that all the reports in Europe about the propagation of the plague from town to town, and country to country, by merchandize, are the offspring of vulgar tales. It is possible that garments *worn by the sick and not cleaned*, may excite the disease in a sound body; but such garments, to retain the infection, must be closely packed in bales, chests or boxes, or the action of the air will destroy the infection, in a few days. And whenever an instance of this kind happens, the disease will die with the patient first infected; it will rarely or never spread, unless the constitution of air is so pestilential, as to produce the disease without infection.

In these positions, I am warranted by a multitude of facts related of European plagues, and many that have occurred in America.

Hence, goods transported from Marseilles, during the plague, did not communicate the disease in Languedoc, Velais or Dauphiné. The true reason of the facts related by Chicoyneau, is, that the air of the whole country about Marseilles was pestilential, and affected most of the villages in Provence, altho some escaped. Further removed from the sea shore, in the contiguous provinces, the air was less pestilential, and the disease did not appear. Goods were conveyed to all these provinces indiscriminately; but they had no concern in the propagation of the plague. The plague appeared, where the pestilential principle was competent to produce it, the seat of which was at Marseilles, a large populous city; but which extended, as it always does, to some distance, beyond which it produced no plague. Wherever the distemper appeared, vulgar ignorance ascribed it to goods; and where it did not appear, after the reception of goods from Marseilles, the vulgar and the learned all agreed they could not account for it; they wondered that goods would not infect people in Languedoc, as well as in Provence—and all the writers on the subject in Europe, from that time to this, seemed to have been satisfied with wondering at the phenomenon.



Of the truth of the doctrine, that the plague will not spread from infection, in an atmosphere not proper for it, we have in America most indubitable evidences.

In every pestilence that has affected our cities for six years past, great numbers of persons, when ill, have been removed into the country, or have been seized after removal, but not one instance occurred of the spreading of the disease in the country to any extent, from such infected persons until the year 1798. There have been a few scattering instances, in which the nurses of such persons have received the disorder. These have been very rare; probably not in one instance of a hundred, has any person been affected by fomites from such diseased persons. Most violent cases of the pestilence, when removed into a pure air, exhibit no infection that is perceptible. This fact corresponds with what has been related of the importation of infected persons and goods into Egypt in June, July and August, which produces no ill effect; but for a very good reason; the air of that country, during the inundation of the Nile, will not generate the plague; and hence the vulgar idea, that it is not imported, or will not spread from infection.

But not only do our country people escape infection, from diseased citizens who sicken and die in their houses, but our cities also, when the constitution of air does not favor the disease, are not affected by the introduction of the worst cases from neighboring cities. Thus in 1793, many persons from Philadelphia, entered New-York, in spite of precautions, taken by the police, sickened and died in boarding houses and other places, but without communicating the disease in a single instance. In 1795, the case was reversed; New-York generated a contagious fever, but Philadelphia did not; and several persons, who left New-York, sickened and died in Philadelphia without infecting any person whatever.

It is unnecessary to multiply examples; the same has happened between Philadelphia and Baltimore; between Norfolk and the adjacent country; between Boston and Providence; in short there is not an exception to the remark, that infected persons, carried into towns and cities where the atmosphere has not been

disposed to *generate* an epidemic, have never propagated the disease. In every case, and the instances have been very numerous, the disease has disappeared with the recovery or death of the first or second patient.\*

But this is not all. In the same town or city, where the pestilence has been general in a particular quarter, another part of the town or city, situated on better ventilated or more elevated land, has not only been free from the epidemic, but has possessed an air capable of resisting the infection of the diseased. This, to a certain degree, was the fact in Philadelphia, where no part of the city can be called *elevated*; yet in 1793 and 1797, few cases of the fever occurred in the western part of the city. But in New-York, New-Haven, Providence, New-London, Boston, and Newburyport, the disease has had its pestilential region, or quarter of the town, in which it became epidemic and infectious; but other parts of the town have been free from it. And in all such instances the most malignant cases, in persons seized in the pestilential region, and conveyed to the healthy part of the town, have exhibited no infection; or if a single nurse has taken the disease, of which I have heard of two or three instances, the infection has there ceased and produced no further effects.

These exempted parts of the towns are the more cleanly and airy situations. To this however occur two exceptions. One in Philadelphia, in 1798, the disease of which year was more virulent and more infectious, than in former years, and extended to healthy positions. The other exception is in New-London, the last summer also; in which town, the disease had indeed its pestilential region, marked distinctly, as before related; but this part of the town, where the disease raged, is as airy and well built, as any other quarter.

Evagrius remarked of the plague in his time, that it sometimes attacked certain parts of cities, and left others untouched. See the year 590.

Pestilential diseases then have an atmosphere in which they

\* In 1798 the first cases of the fever in Chester and Wilmington originated from Philadelphia; but the atmosphere also of the country in New-Jersey and Delaware actually *generated* the disease, in the neighboring districts, and so it did in Connecticut.

rage with violence ; but at a distance, they lose the power of infecting, at least to a great degree. Van Swieten remarks this of the spotted fever in 1756—if healthy persons descended into the valleys where it was prevalent, they took the disease ; but when removed into more airy situations, they infected no one.

Vol. 16. 59.

These facts all concur to establish the principle, that some other cause must act with infection, to render this pestilence epidemic, or to give it effect. The consequence is unavoidable, that the infecting cause, is *not a specific contagion*.

In the second place, the infecting power of the plague and other autumnal diseases, is susceptible of gradation, from the lowest point of danger, up to the highest ; a circumstance that does not characterize the specific contagion of small-pox and measles. In America, we have seen the disease in every stage of virulence, except perhaps the very highest, like that in the days of Gallus and Volusian, that in the time of Evagrius, or that in the reign of Edward III, and a few others. The disease in Philadelphia in 1797 was more infectious than that in 1793, and that in 1798 still more than either. The fever in New-York in 1795 exhibited very little infection, not one case in twenty proceeding from any communication with the sick ; but in 1798, the disease put on a more virulent aspect, and was more generally infectious. In Baltimore, the disease in 1797 ran through all the grades of bilious fever, from an ordinary remittent, which for weeks prevailed without infection, to a contagious yellow fever.

But this is not all. During the same season, and in the same city, the disease exists in all its grades from an intermittent to the contagious yellow fever. It is a very frequent thing for persons seized with decided symptoms of the pestilential fever, to have the disease reduced by early applications, to a remittent or an intermittent. Of this I am an instance myself ; having contracted the malignant fever in New-York in August 1798, from the air of the city, for I was near no diseased persons, and returned home, I was seized with the symptoms, tho not of the most violent kind. The fever was disturbed by early remedies, and I became convalescent ; but in a few days, I relapsed and

the fever took the form of a regular tertian. Dr. Rush relates similar examples in the fever of 1793.

Lind, on diseases of hot climates, p. 179, remarks, that patients, with a mild intermittent, sent to Greenwich hospital, near a marsh, in Jamaica, soon grew worse, and their disease turned to a malignant yellow fever or mortal dysentery.

A multitude of such facts have been observed in America, which, with the remarkable history of the disease in Baltimore in 1797, seem to amount to a demonstration, that the plague and all autumnal bilious disorders, are of one species, differing only in their grades. Indeed the writers on the Levant plague, while they utterly deny such a sameness in kind between that disease and any other, have recorded facts to prove the doctrine here maintained.

P. Ruffel admits that the plague in Aleppo was of very various degrees of malignity, and was not always infectious. He has even arranged the cases in several distinct classes, according to the various symptoms and degrees of mortality.

Lady W. Montague, in letter 31, has the following observations. "Those dreadful stories you have heard of the plague, have very little foundation in truth. I own I have much ado to reconcile myself to the sound of a word which has always given me such terrible ideas; tho I am convinced there is little more in it than in a fever." She then proceeds to relate, how she passed through several infected towns, that her cook was taken ill, and she was told, with a great cold—that she left her doctor to attend him, but the cook soon recovered, and both cook and doctor in a few days, arrived in health at Adrianople. She was then surprised to learn, that her cook had been ill with the plague. She concludes, from her own experience, that the air is never infected and that it is as easy to root the plague out of Turkey, as out of Italy and France.\* She remarks also that "many escape it"—which is certainly wonderful!

Just so carelessly people reason and draw conclusions, from a

\* Notwithstanding this disease was "rooted out of France," it happened that, in two years after Lady Montague wrote her letter, Marseilles was almost depopulated by the disease!



single cursory observation, or an isolated fact; a practice among travellers, as among men of pretended science, which is the source of numberless errors. It is undoubtedly true, that the plague is often "little more than a fever;" but if Lady Montague had been in Cairo in 1580, or in 1736, or in Constantinople in 543, or in 1751, or in London in 1665, or in Marseilles in 1720, she would have thought the plague something more than an ordinary fever. The truth is, the disease exhibits different grades of violence, at different times.

Savary remarks, that such as *catch* the plague in Egypt in June, July and August are always cured.

So observes Mignot, in his history of the Turkish empire, vol. 2. p. 4, "the plague at certain times, is incurable; at others, easy to be cured. The contagion is more or less strong, according to the state of the air."

Similar remarks occur in the *Traité de la peste*. The author is full of his idea of contagion, but he says, the plague, tho' always from one cause, appears differently in different places, and a small distance between them makes it appear like two different diseases, as at Montpellier and at Lyons.

Chandler, in his travels, gives us wonderful discoveries on this subject. He says, the disease proceeds from certain invisible animalcules, burrowing and forming their nest in the human body. These are imported annually into Smyrna—they are least fatal at the beginning, and latter end of the season. If they arrive early in the spring, they are weak, but gather strength, multiply and then perish!!

Such silly opinions are gravely recorded in books, yet they prove that infection is of very different degrees of strength, or that it is the state of the air, and not infection, which produces the disease.

P. Alpinus, followed by Volney, Savary and others, speaks of this difference in the malignity of the plague; but he ascribes it to the *place* where the disease originates. He says, the contagion from Barbary is more putrid and virulent, than from Greece and Syria, and instances that of 1580.

Vol. 3. p. 61 and 2.

It is true that some of the most violent plagues have first appeared in Ethiopia or Barbary, as in the time of Thucydides, in 252, in 1580, in 1736; but these writers ought to have recollected that others equally violent have originated in Egypt, in China, in Italy and in Constantinople. Witness that in 542 which began near Pelusium in Lower Egypt, those of 1347 and of 1450 which began in China or other parts of Asia, and that of 745 which commenced in Calabria, in the kingdom of Naples. They might have observed also, that many plagues, of the most destructive kind, have appeared at once in twenty or more of the cities of Europe. These considerations would have detected the puerility of the notion, that contagion from one country is more "putrid and virulent" than from another, and led the observers of nature to the true cause of these different grades of malignancy, different states of the atmosphere in different periods.

Fernelius divides epidemics into three kinds: An epidemic from exhalations or vapor from the earth; from great changes of seasons; and from an occult, malignant quality in the air; the last, he maintains, is the only true cause of the pestis; the others are preparatory to it; but these causes often unite, and the plague then becomes most severe. Putrid exhalations do not alone produce the plague, but prepare for it and aid its progress. Hence it does not affect all places or all men alike—but is most severe in maritime places; in those exposed to the south; warm and humid, abounding with impure exhalations.

De Morb. Pest. 189.

There is a great deal of truth in these observations, and I cannot but remark how much more correct these authors are who often saw the plague, than Mead and others who had no such advantages.

The violence of the pestilential principle, aided by seasons remarkably debilitating, has sometimes dispatched the human race, with terrible rapidity. The more usual course of the plague is from five to seven days, when death or a favorable crisis takes place. But to this there have been some dismal exceptions. The disease described by Evagrius in 590, generally put an end to life in three days. This also was the period of the crisis in

the dreadful plague, in the days of Vortigern, in 448, and the subsequent years. In the similar calamity of 1348, few patients lived beyond the third day.

In many instances, during these more general plagues, persons have died suddenly, as in an apoplexy; as in the pestilence at Narbonne in 1534, where men frequently fell dead as they were walking or conversing; of which Skenkius himself was often an eye-witness. He cites as authorities for the same fact, Valleriola, Gemma, Salius and Cardanus. See page 765. The same happened in the pestilence described by Evagrius; and authors relate that no less than eighty persons, fell dead in a procession instituted by St. Gregory, about the year 590.\*

Dion Cassius mentions an expedition of a Roman army into Arabia Felix; in which most of the soldiers perished by unusual distempers. Many of them were seized in the head; the brain dissolved, and the disease falling upon the throat, suffocation speedily ended life. This was evidently the effect of extreme heat, producing excessive excitement and soon followed by a total debility of the nervous system.

Terrible indeed must be that virulence of the pestilential principle, which bids defiance to cold. Yet such has been the case in a number of plagues. In the pestilence of 543, says Procopius, the disease invaded some places in summer; others in winter. Evagrius makes the same remark of the plague in 590. The black pestilence of 1348 attacked countries, in northern latitudes, in winter or summer, without discrimination. The disease in Provence in 1720, was not controlled by the rigors of winter. The pestilence in 1591, raged thro a cold winter, in Revel and Narva, in the 59th degree of north latitude. "Sometimes, says Fernelius, the most intolerable heat of summer produces no pestilential disorder; at others, the plague breaks out in winter, and ceases in the midst of summer or in autumn." p. 189.

Diemerbroeck remarks that a plague which begins in winter or autumn, is more violent and of longer duration, than one which

\* This disease sometimes attacks in the form of an apoplexy; in other cases, persons are indisposed, for some days, but able to walk, while the disease is secretly undermining the animal powers. Such persons suddenly pass from apparent health to their graves.

begins in other seasons. So says Peter Paschal, an author cited by Diemerbroeck; the plague which begins in spring or summer ends in winter; that which begins in autumn or winter, is of longer continuance.

The reason of this diversity is very obvious. The pestilence which appears in winter, in northern latitudes, can proceed only from a disposition of the atmosphere; for cold totally destroys all infection of that disease, and all the influence of putrid exhalations. Whenever therefore the plague invades man in cold weather, it demonstrates a *more malignant* state of the air, and one that is not controlled by cold weather or frost. Such a state of the air must of course produce more fatal effects, than an inferior force in the pestilential principle, which perhaps requires the aid of heat, humidity and noxious exhalations to produce a very violent plague. Thanks to heaven, most of the pestilences that afflict mankind are of this latter, or subordinate degree; in which the real plague is limited to places highly charged with morbid substances, which it is in the power of man to dissipate or remove. A vast proportion of all pestilential diseases are found to rage only in cities, jails, camps, and crowded ships, and may be avoided or mitigated by human means.

At the same time, historical facts warrant me in believing, that the pestilential principle does, at times, acquire a virulence, that proves fatal to life, in every season and every situation; assailing indiscriminately the city and the cottage; the cleanly dwellings of the rich and the filthy cells of the poor; the highest hills, as well as the valleys, the borders of morasses, and the nauseous alleys of a populous town. During this melancholy state of the elements of life, and such was their condition during the ravages of the black pestilence in the reign of Edward III. men are however not to despair of preserving life; but the means consist in applications to the human body, calculated to guard, not against infection so much, as against *debility*, the deciding proximate cause of the malady.

Historians mention a remarkable difference in the operation of the two very furious plagues, in 1348 and 1361. That of 1348 was most fatal to the poor; but that of 1361 was most mortal among the nobility and gentry, and on hills and mountains, which



usually escape. In the first case then, morbid exhalations constituted an influential cause in producing the malady—in the latter case, they operated as a shield or antiseptic—and the facts demonstrate the various force of the elemental causes.

In the third place, to give effect to the infection of the plague, and at times, to other autumnal diseases, there must be an apt or suitable disposition in the human body. This is admitted by Hippocrates, who observes that body differs from body, the nature of one man, from that of another, the nutriment of one, from that of another, and the same things are not alike pernicious to one species of animals, as to another. Hence he accounts for diseases invading one kind of animals at one time, another species at a different time, and different species having their various distempers.

Lib. de flatibus.

Thus Galen remarks, that the same causes do not affect all persons alike; if they did, violent heat, excessive fatigue or drinking or anger, or grief, would produce fever in every person; and for the same reason, all persons alike would be seized with pestilence, during the reign of the dog-star.

De dif. feb. cap. 4.

In conformity to these ideas, Diemerbroeck, p. 50, lays it down as a principle, that no person will receive infection, unless his body has an *aptitudinem*, a fitness, or disposition to receive it, arising from some secret quality or bad state of the system.

On this point, we reason without knowing causes; all we can do is to collect and arrange facts, which decide in favor of this hypothesis. We are compelled to admit the principle, not only as it respects the operation of infection, but also of the elemental or primary atmospheric cause of pestilence, which makes an evident distinction, at times, between persons of different habits, families, and nations.\*

\* Medical men are not agreed, as to the nature of what is called *predisposition*. Brown, in Elements of Medicine, defines it to be a less degree of the disease; that is, the commencement of the disease. I suspect this definition, properly limited, to be nearly just. It is probable that all fevers are the effects of debility, and that when this debility commences, a person may be said to be *predisposed to disease*; altho the disease may not be formed in many days or weeks after, or may be prevented by early applications.

These facts came under the observation of Procopius and Evagrius. In 543, says the former, no physician or attendant caught the distemper—while many were seized they knew not from what cause and suddenly died. Many, says Evagrius, who fled from infected places, remained safe themselves, while they communicated the disease to others. Many who remained with the sick and freely handled them, wholly escaped. Others, in despair for the loss of friends, threw themselves in the way of infection, but were not able to contract the disease ; while others received the disease by the slightest connection with infected houses, or in open market.

We have many memorable examples of a similar nature in America—they are too numerous to be specified. I suspect however that four fifths of such cases are improperly ascribed to infection.

Diemberbroeck relates that in the height of the plague at Nimeguen, the air was so bad, that all places were nearly alike, as to the danger of infection ; persons received the disease with or without intercourse with the sick.

Sometimes the plague discriminates between natives of different countries. The French fugitives from the West-Indies, who have resided in our cities during pestilence have generally escaped. This is not however very remarkable ; as they are accustomed to a climate which is, like our summers, peculiarly fitted to produce a similar disease ; at the same time, their manner of living is better suited to the warm season, than that of our own citizens.

But a similar discrimination has been often observed, among natives of the same latitudes, or nearly the same. Thus Cardanus, lib. 8, relates that in a pestilence at Basle, the Swiss only were affected ; the French, Italians and Germans escaped. John Utenhovius relates that in a plague in Denmark, all strangers, as English, Germans and Hollanders escaped, altho they resided in families and associated freely with the infected. The Sudor Anglicus, when it first appeared in England, attacked none but the English ; but in subsequent pestilential constitutions, it invaded almost all Europe.

We have in America most illustrious examples of the distinction above mentioned. In the sweeping pestilence of 1618, when

almost all the Indians perished, on a tract of three hundred miles in extent, some white men wintered in the country and associated freely with the sick, without injury. In a similar pestilence among the Indians on Nantucket, in 1763, not a white man was affected, tho never so much exposed to infection. Two or three other instances have come to my knowledge. A like discrimination took place in Egypt in the time of Moses.

Sometimes the plague singles out particular families. Thus Diemerbroeck observed in the plague at Nimeguen, whole families, by a secret sympathy, were seized all at one time; and in some instances, where the members of the same family lived, at a distance from each other, in different parts of the city, they were all attacked nearly at the same time. What is more remarkable, the same fact was repeatedly observed, where the members of the same family lived in different towns. Of this there were many examples. One man by the name of Van Dans, to preserve his children from infection, sent two of them to Gorcum in Holland, to reside with his friends, and kept the third at home. There was no pestilential disease in Gorcum, at that time, and the two children remained in health for two or three months; but at last both were seized with the plague and died, at the same time that the father and another child died with it in Nimeguen. The mother was seized, but recovered. About the same time, a sister, and two or three other children, residing with another sister, at a distance, and several more remote relations of the family, all perished with the same disease.

So it is related by Evagrius, who was surprised at the fact, that particular families, sometimes only one or two, were arrested by the plague, while all the other inhabitants of the city remained in health. But he remarks further, that those who escaped, the first year, experienced the like calamity in the next. This fact, by the way, is common, and should have led Evagrius and others to observe the progressiveness of the pestilential cause.

Pliny, lib. 7. ca. 50, remarks that old people are usually exempt from attacks of the plague; but that all nations are subject to pestilential diseases, which invade them by kinds or classes,

sometimes falling on servants, sometimes on nobles, and on others by grades or ranks. Nature, says this author, has even prescribed certain laws to diseases. The last remark should have excited the minds of physicians to discover these laws. Such laws certainly exist, and epidemics of all kinds are connected in principle.

I have met with other instances of discrimination, perhaps more remarkable. One is related from John Helwigius, in Bonetus' Collection of Northern Medicine, page 228. In 1621, when the small-pox raged with great mortality, it was remarked that persons of the same blood, as brothers, cousins and other relatives, living at a great distance from each other, and as far as from Nuremberg to Lyons in France, were seized with the disease at one and the same time. I draw no important consequences from this fact, because this disease is not *limited* to particular families, altho it may seize one family before it does another.

Another instance is related by Van Swieten, Vol. 16, from Heister, an author of undoubted credit. At Altdorf, in Franconia, broke out in 1711, a malignant fever, approaching to the plague in violence, but not with the glandular tumors. This disease attacked none, but the students or others of the university; but it seized them wherever they were dispersed in private families, in all parts of the town. It seized the professors also and their families, but went no farther by infection. It attacked also the printer to the university and his workmen, tho at a distance from the college; while another printer, contiguous to the college, escaped. Students also belonging to the university, tho at home, as at Nuremberg, were seized. It was thus restricted in its attacks, and exhibited no infection, beyond these descriptions of persons.

It must not be omitted, that this was a very sickly period in all the north of Europe. In this same year, the plague raged in Copenhagen, and it had in the preceding years, spread over Poland and along the Baltic.

This fact at Altdorf is by far the most singular, that I have found in history; but that a violent disease should attack persons of one blood, and not of another, is less surprizing. We have



recent proofs of this discrimination in America. In 1796, three persons of one name in Hartford, two brothers and a cousin, were suddenly seized with a violent fever, of a putrid tendency, tho in winter, and carried off within a few days of each other. At the same time, two or three others of the family were seized less violently in the same town and recovered; and what is more singular, two other brothers, one in Litchfield, 30 miles from Hartford, and another in New-York, 130 miles distant, were attacked nearly at the same time, and were very ill, but survived. No infection could have existed in most of these cases, as the persons did not see each other.\*

Another instance occurred in Cambridge, Massachusetts, and is stated to me by the attending physician.

In October 1791, a young woman, belonging to a family in that town, but who had, for two years, lived at a distance of three miles from her father's house, was seized with a putrid bilious fever. Her mother repaired to the place and nursed her, till she was convalescent. None of the family visited her while sick, except the father occasionally, and her eldest sister. The latter took the place of the mother, for a few days, who was called home to attend two other children who were seized with the same disease, and who had never been exposed to infection. Before these recovered, three others were taken with the fever in the same family. The three last had doubtless assisted in nursing the sick or been into their rooms, and therefore might have been infected.

In April following, another of the children, who had lived at a distance from the family and had not been permitted to see any of the sick, was seized with the same fever, at the house where she lived. In the same month, the father and another child, were taken with it at home. Not one of the family, at

\* A curious fact is related to me by Dr. Dutton of Oxford, in Derby. In the year 1795, almost every male child, born in the beginning of the year, in that and the adjacent towns, died within a fortnight by convulsions, but no female child was affected. This was observed to be more frequent in families that had been affected by the scarlatina, in the preceding year.

It will be remarked that this was near the district of country which had suffered by a pestilential fever and dysentery.

home or abroad, escaped, except the mother, who had nursed all the sick, except one, and was most exposed to infection. The diseased were very offensive, but all recovered, except one; and neither my informant, the attending physician, nor any nurse or visitor, out of the family, was in the least injured by infection.

M. S. letter from Dr. Wm. Gamage.

This disease was a family pestilence, which began in autumn, was suspended by the cold of winter, and revived in spring. It resembles, on a small scale, the great plagues in London and Marseilles, and many others, in which a few cases occurred, in the preceding autumn, clearly marking a pestilential state of air, in that particular city, which state was arrested in its operation by cold in winter, but again exhibited its effects in spring.

The limitation of the disease to a particular family, of the same blood, or disposition to be affected by a certain morbid state of air, is a mysterious phenomenon, but the fact is so well ascertained, as to leave no room to question its existence. We can ascribe it only to a general state of air, fitted to produce injurious or fatal effects on bodies of a particular temperament, which temperament or disposition consists in the invisible structure or organization. It is demonstrated that infection cannot be the only cause of the diseases in these families; and of course we are compelled to admit the existence of another cause, which can only be the atmosphere, for no other cause extends its operation to the distance at which the effects were produced.

It is on this principle alone that particular persons or families escape the worst plagues that have afflicted mankind, as related by Evagrius, and all authors on the subject, and of which we have numerous instances in America. But,

"Why drew Marseilles' good bishop purer breath,  
When nature sickened and each gale was death?"

is the interrogatory of an inimitable poet, which has never been answered; for on this subject, as on every other, we are baffled and confounded, when we attempt to reach primary natural causes. The interior organization of animals and vegetables, is far beyond the limits of human investigation.

Lord Verulam has left a passage confirmatory of the foregoing principles. "The plague, says this great observer of facts, is not easily received by those that continually attend the sick, as physicians; nor again by old people, and such as are of a dry, cold complexion. On the other hand, the plague soonest seizes those that come out of fresh air, those that are fasting and children. It is also noted to go in a blood, more than from stranger to stranger."

Works, Vol. 3.

It is in analogy with the foregoing facts, that animals of different species are affected with epidemic diseases, which bear a similitude in their predominant symptoms, at different stages of a pestilential constitution of air. Sometimes, horses, cattle and sheep feel the operation of the destructive principle, at the same time with man. At other times, this principle will affect cattle a year before it reaches mankind. Sometimes, it first assails the human race, and afterwards the irrational parts of creation. In some years one species of animals is affected; the next year, another. Thus horses experienced the epidemic of 1793, in the vicinity of Philadelphia, in the winter following the plague in that city. The cats perished in 1797. The fish in James' river died in 1797, the oysters on the shores of Connecticut sickened in 1794, and the fowls in Connecticut in 1796.

Not unfrequently, the force of the pestilential principle, in one country, seems to expend itself principally on the brute creation; while, in the same year, or succession of years, its principal operation, in a neighboring country, is experienced by mankind. Thus in 1712 and 13, a very pestilential period, the cattle in Italy, Germany and other places received the full force of the pestilence, in a desolating epidemic, while in Austria, Hungary and the east, the pestilence fell on men. Thus also in 1770, while a dreadful plague was raging in Turkey and Poland, a mortal distemper swept away the cattle in Holland, Flanders and some parts of England, and malignant fevers prevailed in some parts of America.

That the great general cause of the diseases, among the different species of animals, is the same, is obvious from this consideration, that during the same constitution of air, or pestilential

period, the diseases of man and beast have a number of similar symptoms; such was the fact in Austria, Italy and Germany in 1712 and 13; and such has been the case in the United States.

In conformity with the general principle above mentioned, we observe that however analogous may be the symptoms of diseases in man and beast, the distempers of one rarely infect the other. Infection is limited usually to that species of animals, which have an aptness to receive the operation of the primary atmospheric cause of the disease. Thus diseased horses do not infect men, nor diseased men, horses. So when a plague attacks the natives of a particular country only, the infection, like the primary cause of the disease, is restricted in its operation to those particular people. But this is rarely or never the case with the specific contagion of the small-pox and measles, in regard to mankind.

Authors indeed relate that hogs, dogs and poultry, feeding on highly infected articles, or wallowing in the filth thrown from houses, during the plague, have died with a similar disease. A few instances are mentioned by Diemerbroeck, Boccace and others. Hodges mentions a disease taken from a horse, which ceased without becoming epidemic.

But these isolated facts form no exception to the general rule; for such distempers never spread and become epidemic. They only prove my general doctrine, that the contagious quality of plague, is not a specific principle, but a quality capable of every possible degree of force—that in its lower or more attenuated forms, it affects few or no persons whatever; but it *may* be so concentrated or condensed, as to destroy life, not only in bodies of an aptitude to receive the poison, but also in other species of animals, which have no such aptitude. Hence, the poison generated in the clothes of the sick, when put into chests or packages, uncleansed, in hot weather, may be so concentrated or increased by fermentation, as to kill almost instantly, the person who opens them. But an infectious disease thus produced, will never spread far, without the aid of a state of air which is pestilential. On the other hand, from thousands of instances in books, and within the knowledge of Americans, who are annually, monthly and weekly receiving infection from the West-



Indies, we know that the infection soon disappears in a healthy constitution of air. It may be so virulent as to give disease to the persons who first approach it; but in these the disease is extinguished.

It should be further remarked, as a useful hint, that persons removing suddenly from fresh air to an infected place, are doubly exposed. The increase of the pestilential causes is usually gradual; therefore persons who live within their operation, are insensibly fitted, by the flexible texture of the system, to sustain their effects. But sudden changes are very dangerous. The body will hardly ever sustain great changes in the powers of excitement, when suddenly made. Hence the extreme danger of removing from fresh to infected air; and sometimes, of removing from infected to fresh air. The sudden alteration in the stimulus operating on the system, may be as fatal in one case as the other.

Another distinguishing circumstance, in pestilential diseases, and one that decisively marks different grades of violence in the causes, is, the manner in which the disease invades neighboring cities. It is always observed, that during the prevalence of the plague, it attacks cities or towns at some distance, in one year, leaving other towns in the intervals between them, untouched; the next year perhaps, or the second year after, it invades those intermediate towns which had escaped. This is always the fact, and it has puzzled all authors who have related it; yet the fact has never been accounted for, as its causes have never been understood. Mead, who was not personally acquainted with this disease and whose theory led him to explain all its phenomena by contagion, was greatly embarrassed with this fact. He instances the escape of Vicenza, in Italy, 1575, when Verona and Padua, one on each side of Vicenza, were severely afflicted; and in the next year, Vicenza was desolated, when Verona and Padua were exempt. He could not explain how the infection, which came from Trent, where the disease first appeared, should pass over Vicenza and reach a more distant city.

Erroneous theories are the source of innumerable mischiefs in science. The fact is a common one, and on a just view of the causes of pestilence, is very easily explained. And what is

surprising, Procopius and Evagrius have recorded facts which afford a clue to the secret, altho medical writers, from their days to the present time, have suffered them to pass without notice. Procopius mentions that the pestilence which began in 542, spread over the earth, but "if it passed by a particular country at first, or *slightly affected it*, it soon returned upon it with the same desolating rage, which other places had experienced." Evagrius also remarks, that "some places were more slightly affected;" and in another passage he says, that in some cities a few families were seized the first year, and the rest of the city, the year following.

Here we have a clue to the mystery. The plague seizes first the cities and towns where the *general*, or *local causes* are the most powerful. Thus, the plague of 1575, which puzzled Mead so much, commenced in Trent on the Adige, which, all geographers agree, is a most unhealthy place. It next attacked Verona and Padua for a similar reason, and afterwards Vicenza, the intermediate town. The general cause, in the elements, had been four or five years in operation, producing a fatal spotted fever, in most parts of Europe, continually increasing in malignancy, until it arose to the plague, and its crisis must naturally be in places where it was most aided by local causes, or where the general cause first increased to its full force.

The slight pestilences mentioned by Procopius and Evagrius, were the *precursors* of the severe plagues to follow; precisely as in London and Marseilles, a terrible plague was preceded, in a former year, with malignant fevers and a few cases of plague. All history affords a tissue of proof, that the plague is never an isolated disease, starting up suddenly from infection; but the *crisis of a series of violent diseases*. To this I challenge the partizans of specific contagion to name an exception.

In America, we are able to solve the phenomenon of the escape of places intervening between infected towns. We find, without an exception, that when two cities are infested with pestilence, and an intervening place is not, if that intervening town is to be attacked the following year, the precursors of the disease appear there, during the pestilence in the towns on each side.

of it. Thus the late series of plagues *began* in New-York in 1791, in Water and Front streets, where the *local* causes were most powerful. At this time, appeared sporadic cases of bilious fever, more malignant than usual, in various parts of the country, every where, indicating the commencement of a pestilential state of air.

In 1792, these indications continued, and in a few cases appeared the scarlatina, a new evidence of the reigning constitution.

In 1793, the crisis arrived in Philadelphia, with serious mortality; and the indications of pestilence appeared in a great increase of mortality, in many parts of the country.

At the close of this year, New-Haven, which was to be next attacked, began to show the forerunners of the disease, in the scarlatina, and in an increase of mortality of about one fifth. In the next summer 1794 appeared the bilious plague. In the same season appeared the disease in Baltimore, distant from New-Haven about 290 miles, while Philadelphia and New-York, intervening cities, escaped. But let it be observed, that a number of cases of the disease occurred in Philadelphia; and New-York which was to be assailed in the next season, produced its precursors, in about thirty cases of violent bilious fever, ending in black vomit. Thus while on the extremes, New-Haven and Baltimore were severely visited, the approaching pestilence was announced in New-York, by a pestilential atmosphere, of a less degree of malignancy.

In 1795 appeared the epidemic in New-York and in Norfolk, Virginia; while Philadelphia and Baltimore, intermediate cities, escaped, altho the heat and humidity of the season every where rendered the country unhealthy. In this year the pestilential principle showed itself in New-London and Providence, in distinctly marked cases of the bilious plague.

In 1796, scattering cases occurred in the northern parts of America. In Newburyport, pestilence prevailed, but preceded by an increase of mortality, its precursor. The same disease prevailed in Boston, New-York, and Charleston, while intermediate towns escaped.

In 1797, it appeared in Providence, Philadelphia, Baltimore and Norfolk, while New-York escaped an epidemic, but a few very malignant cases occurred, showing the existence of the general cause.

So far as I can discover, not a spot on the globe has ever been visited with pestilence, without its precursors, sometimes one, two or three years, but always for some months, before its invasion.\*

If we had bills of mortality for Vicenza, in the years 1570 to 1576, or a history of the diseases in the town, during that period, I pledge myself that we should find, that during the plague in Verona and Padua, on each side in 1575, some malignant disease prevailed in Vicenza, which greatly swelled the bill of mortality for that year, and which announced, with almost infallible certainty, the approach of the plague. Instead therefore of saying Vicenza escaped the pestilence, the first year, when Verona and Padua were afflicted, we should say, the pestilence had commenced in less malignant distempers, but its crisis in Vicenza was to be a year later. This is the whole mystery, and the uniformity of this series of facts from the days of Procopius to this hour, renders it a matter of astonishment, that medical and other scientific men, should have overlooked this great law of epidemic pestilence.

Diemerbroeck remarks the fact, as well as Procopius and Evagrius, that pestilence does not invade all places at once, but now this place, now that, and thus, in a series of years, extending over the earth. See p. 50 of Diemerbroeck, and the foregoing history of the plagues in Justinian's reign. But no author seems to have observed the progression of a general pestilential principle, which, if it does not occasion plague in two contiguous towns, the same year, occasions plague in one, and other malignant diseases in the other, which certainly indicate its approach.

\* Thucydides relates that the year of the plague at Athens was remarkably free from other diseases preceding, and that the plague fell suddenly on the citizens. This may seem an exception to my remark; but is not; for all the neighboring people were collected into the city; which was besieged; a circumstance alone sufficient to account for the sudden attack of the disease.



To prove that infection has no concern in this last mentioned phenomenon, according to the theory of Mead and others, it may be observed that the invasion of the disease in cities, is perfectly analogous to its invasion of a whole country. The disease rarely begins at one point and spreads from that, like the radii from the center of a circle, nor does it follow the nurses and attendants of the persons first seized. On the other hand it starts up in various distant parts of the town, among people who have no intercourse with the infected. To this, it may be alleged, the fevers of Philadelphia in 1793 and 7 are exceptions; but on critical examination, I find they are not. That in New-Haven may be an exception. Thus Evagrius relates, that at the beginning, the plague seized particular families, sometimes only one or two, and the rest of the town escaped, till the next year.

Baronius from Gregory of Tours has well described the first progress of the plague, in 590, in the southern cities of France. He says the disease was introduced by a vessel from Spain; the first record I can find of supposed importation by water. But when introduced, it did not seize every house at one time but left intervals. "*Nec statim hoc incendium luis per domos spargitur totas, sed interrupto certi temporis spatio, ac velut in segetem flamma accensa, urbem totam morbi incendio conflagravit.*" Vol. 8. 15. The metaphor here employed will appear striking to those who have seen a field of stubble or the woods on fire, in a windy day. The fact also corresponds exactly with what has been observed in London, Marseilles and other places, that the disease at first starts up here and there, in remote situations; then subsides for weeks perhaps, before it spreads and becomes popular.

Thus in Nimeguen, a few cases occurred in November; then there was an interval of suspension; in January, more cases, and in March, the disease began to assume the shape of an epidemic.

Dien. p. 6.

In London, says Hodge, two or three persons died, in one family, with symptoms of the plague in 1664.—In the holidays, occurred another case—but a hard frost suspended the action of the infection. The diseased were at first shut up and guarded; but to no purpose. An order was issued and enforced, that a red cross should be set on infected houses, with these words inscribed, "Lord have mercy on us."—

In May and June the disease to use the author's own words, "reigned doubtfully;" sometimes in one part and sometimes in another; and to use Hodges quaint expression, "it kept up a running fight," alternately inspiring hope and fear. This description is less elegant than that of Baronius, but it expresses the same ideas of the first progress of the plague.

It is strange however that the writers should not have seen that their facts totally overthrow their own ideas of infection; it being impossible, that the operation of infection should be thus suspended, and afterwards revived. Frost totally annihilates infection, altho it does not destroy the atmospheric cause of diseases. Similar, in all respects, was the commencement of the plague at Marseilles in 1720. At first a few persons died suddenly, then the disease disappeared, and the citizens supposed it to be ended. Repeated hopes and fears were revived by the alternate appearance and disappearance of the malady, for some weeks in May and June. Yet the author who has related these facts made a book to prove its origin from Levant infection! so absurd are men when they attempt to support preconceived systems!—

In America, the pestilential fever has first made its appearance, in a similar manner. It has every where been preceded by an increase of mortality, and in most places, has appeared in the scattering, interrupted manner of the plagues before mentioned. In Philadelphia in 1797, and still more in 1798, scattering cases occurred in June and July, several weeks before the arrival of the supposed fomites, from the West-Indies. The same fact occurred in New-York in 1795; some cases appeared two weeks before the arrival of the Zephyr, the supposed source of infection. In Providence occurred the same fact.

The whole secret of these phenomena, is, that infection has usually nothing to do with the *origin* of the disease, according to the decided opinion of the learned Diemerbroeck, who saw the progress of the disease in Holland, and found it impossible to ascribe it, in many places, to that cause.

The reason why persons are seized, in remote and scattered situations and after different intervals of time, is, that the malignant principle is *progressive*. In its state of increase, it first pro-

duces diseases of a less violent type, and especially all kinds of eruptive diseases and catarrhus affections; as influenza, measles, small-pox, every species of angina, petechial fever, and lastly plague. In winter, the same cause often occasions epidemic pleurisy, or peripneumony of a most mortal kind, and always bearing some likeness to the epidemics of summer and autumn.

In this progression or increase of the pestilential principle, those persons are first seized, who have the least power of resisting its operation. This inability may proceed from various causes. It may be occasioned by the natural organization of the body; some bodies being naturally more susceptible of disease, than others. This indisposition of bodies to repel the morbid action of air or other causes, is hidden from the eyes of man; but that it exists, we have proofs in every days experience.

Other persons are predisposed to certain diseases by artificial means. Thus every excessive stimulus, induces indirect debility, a fruitful cause of diseases. Hence the liability of robust people to all violent fevers.

Others may be exposed to pestilential diseases from living in situations, where the pestilential principle is assisted in its operation by the debilitating qualities of morbid exhalations. Hence the early appearance and furious ravages of the plague in the narrow streets of cities, and the filthy apartments of poverty.

From these and other causes, it happens that some persons are seized with pestilence, long before the bodies of others yield to the action of the destructive cause. This will rationally account for all the variety of phenomena, which accompany this ferocious malady.

The same reasoning applies to the angina maligna, which is only another form of pestilence. Fothergill relates, that this disease appeared in London in a few cases in 1739, and then disappeared for a period of two or three years. It did not become epidemic, tho very infectious.

Works, p. 198.

To confirm this hypothesis, I may remark that the plague is less infectious on its first appearance. This is admitted by Ruffel, on the plague of Aleppo, p. 19. 300, 297 and 315. At the same time, it is agreed on all hands, to be more mortal, than

in its later stages. If infection were the cause, the reverse would be true, and the disease would be more mortal, in proportion to its extension, and the accumulation of infectious matter. The first cases also would be equally infectious, within the reach of their effluvia.

Skenkious observes that many persons lived in infected houses, where others were diseased, for three or four weeks, without any ill effects; but they afterwards sickened and died. This he ascribes to an increase of infection, and recommends, as the means of prevention, changes of clothes, and liberal use of water in the apartments. The fact may be explained on this principle; or it may be, and most probably is, the effect of the slow operation of the morbid air in inducing debility on particular systems. But it goes to prove that the infection of the disease is not specific contagion, but a vapor or acid, unfriendly to health, that is capable of every imaginable degree of force; slighter degrees of which require a long time to undermine the energies of life.

Another consideration, which decides against the origination of the plague from infection, is, that almost all other diseases, whether infectious or not, exhibit the phenomena just described. It is not the plague alone that appears, this year in one town, and the next in a contiguous one; or this week in one family, and the next in another; or at the same moment, in two families or towns, at some miles distance. The same phenomena characterize dysentery, measles, anginas and other maladies which are infectious; and even intermittents, remittents, and some others, which are not spread by infection.

Such was the manner in which the fatal dysentery of the period about the year 1751, leaping from place to place, in different years, ravaged Connecticut, for three or four years. The same took place, with that disease, from 1773 to 1777. It was scattering from place to place, during a series of years, and then almost totally disappeared, for many years. Sometimes it spread over a whole town; at others, it was limited to a particular street. In some instances, it swept away a large part of a family; in other instances, families entirely escaped. The same has been its progress, during the last five or six years. In 1794,



it ravaged Derby; in 1795, New-Haven. In 1798, it invaded a particular street in the country, two miles from Stamford, was infectious and mortal, while the town generally escaped.

The scarlatina from 1793 to 1796, exhibited the same facts. Its general progress was eastward, but it often passed by a town and first seized one beyond it.

The angina maligna in 1735 and 6 was remarked for the same manner of appearance. It began in Kingston, in New-Hampshire, but instead of a regular progress, step by step, it seized Boston, fifty miles distant, before it did Chester, only six miles distant; yet its general progress was westward, and hardly any place escaped. Both this disease and the scarlatina of the last period, resembled the plague in these other respects—they were most mortal at first; and they affected families with very different degrees of violence, slightly troubling some, and extinguishing the lives of all the children in others.

The invasion of the influenza exhibits similar facts. It seizes at first only here and there a person; afterwards it becomes general, as at Edinburgh in 1762. See *Essays and Obs.* Edin. vol. 3. At other times, it has seized whole towns in a night; nor does it proceed from town to town, according to their order on a map. Yet its general course is in one direction.

I could produce a multitude of similar instances of pleurisy, and common autumnal fevers not infectious, which appear one year, in one part of the country, and another, in another, without any visible cause for this variety. The instances related by Dr. Buel of the town of Sheffield, are very distinguished. See my *Collection on the Yellow Fever*, p. 53 and 60. That town contains two large ponds, which make considerable marshes, that are sources of remittents. In 1794, remittents of unusual violence appeared within the miasmata arising from the south pond—in 1795, a similar fever raged in the vicinity of the north pond.

This appeared at first an unaccountable phenomenon; but afterwards the fever about the south pond in 1794 was ascribed to the drawing off the water, and exposing great quantities of putrescible substances to the action of heat. But still the difficulty is not removed. The north pond is admitted to be the most

usual and fruitful source of diseases; but these did not appear, in any extent, in 1794. The question then is, not why the diseases occurred, in that year, about the south pond, but why they did *not* appear about the north pond, the principal focus of sickness in other years, and about which they raged with melancholy effects in the two following years? No alteration is suggested to have been made in the circumstances of the north pond; yet in one year, its exhalations were almost harmless, and in the next, they spread desolation over the neighborhood.

See Medical Repository, vol. i. p. 458.

In such cases, just reasoning leads us to suppose the general state of the air or the local exhalations or both, differ materially in the degrees of their force and activity, in different years; but to human eyes, the cause of this difference is not often visible.

Sometimes a severe epidemic will rage in one town and a milder epidemic of a similar type in the vicinity. Thus Zimmerman observes, that he has known a violent diarrhea follow a suppressed perspiration in September, in one town, when a dysentery was epidemic in the neighboring country. To what shall we impute this difference of diseases, within a few miles, of each other, but to the different force of local causes? A general cause, as a hot season, may predispose the body to a disease of a particular type, but this principle may be modified by innumerable circumstances on the surface of the earth.

In analogy with these facts, is the manner in which pestilential diseases invade different species of animals. In one place, horses are seized; in another, cows; in a third, sheep. In one year cats fall victims to pestilence; and the next, hens and geese; but infection has no concern in these phenomena; and we are to ascribe them to the various force of the pestilential principle in different seasons and places.

The phenomenon now under consideration has not escaped the observation of other physicians in Europe. Stapfer, cited by Zimmerman on *Physic*, relates that the village of Oberwyl, in the Canton of Berne, was attacked with a violent dysentery in 1749, while the neighboring villages were free from the disease. In the next year, Oberwyl was healthy, while the neigh-

boring villages were ravaged with the same disorder, tho not separated from the other by any mountain or forest. I have occasion, says Zimmerman, to observe something like this, almost every year.

The English Editor remarks on these facts, that "the dysentery, like other contagious diseases, is spread by communication with the infected persons and clothes, and *therefore* it is not strange that one village should escape, if its inhabitants were careful to avoid communication with their infected neighbors."

Just so important are all the reasonings of the infection-sucklers ! The remarks are common-place and do not reach the point of difficulty. The question, is, to know why several villages escaped the disease, in the year when infection was *near* them, and were seized, the next year, when *no* infection existed. The winter's cold totally extinguishes the infection of that disease ; so that the learned Editor is left without a resource. If any infection had survived the frost of winter, it must have been in the village first infected, and in that place common sense and observation would teach us to look for a revival of the disease, the succeeding spring. But no ; that village is in perfect health, and others, where there had been no fomites, are laid waste by its ravages.—Such are the facts, and no theory of contagion is able to explain the cause of their existence, in regard to this or any other disease.

The dysentery also has, in some places, made the discrimination, observed in the plague ; seizing persons of a certain nation or blood, and not affecting others who are equally exposed. In an epidemic dysentery in Nimeguen, the French and Jews all escaped.

Van Swieten, vol. 16. page 57.

There is a fact related by Hodges and Diemerbroeck respecting the plague which must not be omitted. Many persons who had breathed the pestilential air of London and Nimeguen, went into the country, where they had the benefit of good air. Here they lived in health a month or two, then sickened and died of the plague. This is attributed to the latent poison, which lies long inactive in the system, then operates to the destruction of life. This may be the cause ; but is it not more natural to ascribe the fact to higher excitement from a pure air, on a debilitated

system, inducing indirect debility? Or shall we suppose that a pestilential atmosphere is most stimulant, and that a removal into a pure air, induces direct debility? Perhaps the following facts will throw some light on the subject.

In 1789, I left Hartford in October, when the influenza was spreading in that town, and was seized with the disease just after I arrived at Boston. A fortnight after, I returned, with two ladies who had lived in Boston. In a week after my arriving at Hartford, the town of Boston was attacked with the influenza, and the two ladies at Hartford were seized at the same time. The conclusion I draw from the fact, is, that the constitution of air, producing the epidemic, is some time in operation, before its effects are visible, gradually inducing a disposition in the system to that disease; and as it is progressive, it requires about the same time to run through its course in one place as in another, and is not always interrupted by local causes.

But the most incontrovertible evidence, that infection is not the primary, controlling cause of the plague, arises from the manner in which that epidemic ceases.

If infection were the principal and specific cause of its propagation, it must rage forever, or as long as any of the human race should survive to receive it; for the longer the disease exists, the more extensive must it be. This conclusion is inevitable; for if infection spreads the disease so rapidly, that one or two diseased persons diffuse it in a few weeks over a city, the same principle must, in a given time, extend it over the whole earth, unless its operation should be arrested by a superior cause. And as one diseased person is supposed to infect more than one healthy person, its progress must be accelerated, in a duplicate, triplicate and quadruplicate ratio to its distance from its source. Its velocity also must be increased, not only by numbers in a crowded city, but by an augmented virulence, until all the inhabitants should be destroyed. But all this is contrary to fact.

Most plagues are modified and regulated by the seasons; but the cessation of pestilence in different countries, is in different seasons, and seems to depend on opposite principles. In Egypt, a warm country, never reached by what may be called *cold*, the



plague begins in winter, as in December, January or February ; after the Nile has subsided within its banks, leaving extensive plains and numerous canals, exposed to a hot sun ; with a slimy surface and stagnant water in abundance, on the face of the country. During this period also blow the southerly and suffocating winds, hot and dusty, from sandy deserts, which may augment the causes of disease.

On the other hand, the disease ceases in June, when the Nile overflows its banks, spreading fresh water over the face of the country ; at which time also begin to blow the cool refreshing egyptian breezes from the north or Mediterranean sea.

Hence it is obvious that the existence of the disease depends on the general state of the atmosphere ; for the inundation of the Nile certainly does not wash away the infection from the houses and clothes of the sick. On the other hand, the plague ceases, when the infection is most general, and this is true in every instance.

It may be said, that the plague arises from putrid exhalations in Egypt, and the reason why it ceases, on the rising of the Nile, is, that the expansion of fresh water over the country and a pure northerly air, destroy these exhalations.

In this observation there is truth ; and it would account for the origin and the cessation of the plague, if it was an annual disease, regularly influenced and entirely governed by the seasons. But here again we are overthrown ; for in most years, putrid exhalations, which always exist at a certain season, do not produce the disease. Thus we are driven to seek another cause, which is *not* influenced by seasons ; and to suppose its *co-operation* with hot winds and stagnant waters in the generation of the disease. This is most indubitably the fact.

Again, the plague in Syria, farther north, where some winter's cold is experienced, begins in spring, as in February or March, and ends in June and July, during the most excessive heat of the summer. This is the fact, from Aleppo to Jerusalem, and has been, from the earliest records extant.

Here then different causes, extreme heat and drouth, seem to control the rage of the plague. But does heat destroy infection ? Never, unless by combustion. No degree of heat that is ever

felt in the tropical regions, or in America, has ever mitigated the force of infection, but always has increased it. Now we know, that the heat of Syria, never exceeds in degree what is annually experienced in the West-Indies and the United States, to the 42d degree of latitude certainly, and probably to the 44th. In one respect Syria differs from this country; the summers are longer than in the northern states of America, and the climate subject to drouth. But it cannot be the duration of the heat which destroys the plague; for that disease ceases at the very beginning of summer. It abates in June, and rarely appears, to any extent, as late as August. Nor can we conceive why drouth in Syria should put an end to the epidemic, for in most other countries, it has not that effect. In Europe and America, extreme drouth has very often inflamed its violence.

In this instance then we find no cause for the cessation of the plague, in the weather or seasons, which we are able to comprehend. We know the uniformity of the fact; and all beyond this, is conjecture. Infection can have no concern in the effect; unless on some principle hitherto unknown, cool weather generates it and heat destroys it, contrary to facts in all other countries.

Certain it is, that the plague at Aleppo, Damascus, Said, Jerusalem, Latakia, and on all the Syrian coast, ceases in extreme hot weather, and when the infection is in its utmost extent and violence.

In Italy, Constantinople, in all Europe and the temperate latitudes of America, ordinary plagues yield to cold; that is, they cease as epidemics of that form; but the general cause never fails to show its influence, in giving to the disorders of winter, some of the general symptoms which characterize the epidemic of the summer. This proves that, in common pestilence, morbid exhalations aid the atmospheric cause in producing the epidemic; and that it is not specific contagion which contributes to spread the disease, for this is not influenced by cold; but it is morbid exhalations, that yield to cold. Hence, in northern climates, cold suspends the action of the two subordinate causes of pestilence, morbid exhalations and infection; and this is usually sufficient to check the epidemic.

But that the great primary cause, is not affected or rather subdued by cold, is apparent from these facts ; that altho the plague, in its peculiar autumnal form, is suspended, yet the diseases of winter, as pleurisy and peripneumony, wear the same character ; which can be occasioned only by the continued action of the same cause. Further, some plagues have not yielded to cold, as I have before observed. Several instances have occurred, in which the disease has run through all the seasons without interruption or abatement. This fact demonstrates that the primary cause, existing in the essential properties of the elements, may be of various degrees of force, and at times does actually arise to a degree, capable of producing and continuing that disorder, not only without the aid of morbid exhalations and infection, but in defiance of cold.

In conformity with this idea, is the fact that a pestilence which begins the earliest in the season, is the most mortal. This is agreed by P. Alpinus, Van Swieten and Sydenham, "*Minus sæva est, quo tardius illuc accedit, viderique inceperit ; ita ut quo tardius venerit, eo mitior ac brevior sit judicanda*," says Alpinus, *Rerum Egypti*, Vol. 3. 70. The reason of which is, that in proportion to the strength of the elemental cause, it begins to exhibit its effects early in the season ; that is, with the *least aid* from heat, noxious effluvia or other local causes.—If the general contagion of the atmosphere is very powerful, its effects may appear even in winter, in opposition to cold ; hence the justness of Diemerbroeck's remark, that pestilence beginning in winter, is the most fatal. If, on the contrary, the general constitution of the air is less hostile to life and health, it will not produce an epidemic pestilence, till it is assisted by great heat and local vitiation of the air ; therefore the disease will not appear, till late in the season.

Something like this, on a small scale, has characterized the different epidemics in Philadelphia. In 1793, the precursors of the epidemic were light, and the first cases did not appear, till the last of July or beginning of August. In 1797 and 98, the first cases occurred in June, and the disease in the latter years, was marked with by far the most malignant symptoms, altho the

timely evacuation of the city prevented bills of mortality equal to that of 1793.

In New-York, this circumstance, it is believed, has been less noticeable; but it may be remarked, that in the years of the epidemic, the first cases occurred in the last week in July, and in years, when a few sporadic cases\* only have appeared, they have not occurred till many weeks later. Besides, it is very obvious that the diseases of 1795 and 6, if not of 1797, were powerfully influenced, in their commencement, by local causes; as great masses of putrid matter, in the parts of the city, where the first cases occurred, and where the epidemic exhausted its principal force.

In general, it may be observed in our climate, that if a malignant fever does not appear, in a city, till late in August, the citizens need not apprehend very general desolation. If cases occur early, as in June, there is serious ground for apprehensions of danger. The only exception to these remarks, is, when the seasons suffer some great, unusual and sudden vicissitudes, which, during a pestilential period, may overwhelm a city with almost instantaneous calamity.—Such may be a sudden invasion of heat in August, after preceding cool weather.

In general it is a just remark, that as the force of the pestilential principle, is of various degrees, in different periods, so when it is most powerful, it attacks men the earliest in the proper season, and is destined to be the most destructive.

The preceding facts and conclusions seem sufficient to establish the great point, that neither contagion nor infection has ever had much influence in originating or propagating pestilential epidemic diseases of the autumnal kind.

\* The advocates of the specific contagion of the plague do not admit that the true plague ever appears in sporadic cases. They think, if it once appears, its contagion must of necessity, spread it. This is all a whim. I believe, with Dr. Mitchell, that any disease of the worst type, may be generated in the body, solely by a derangement of the functions of the stomach and intestines, and the poisonous air extricated from food. But that sporadic cases of plague may occur and do occur very often, I have not the least doubt. During the late war, in 1776 or 1777, two brothers by the name of — arrived from the army at Greenwich in Connecticut—one had a malignant fever, with glandular tumors; the other was his nurse and in good health. The sick man died soon after he arrived, and in less than 24 hours, his brother was also in his grave. This was true plague; but no other attendant was infected.—



But objections remain to be answered. It is alleged that the plague begins in maritime places and thence spreads into the country adjacent. Thus it is asserted by the college of physicians in Philadelphia, that the pestilential fever in America "commences invariably in our sea-ports, while inland towns, equally exposed to the ordinary causes of fever, escape." Memorial, dated Dec. 5, 1797.

Pliny, a great observer of facts in the natural world, goes farther and asserts, "That pestilence is observed always to proceed from southern regions towards the sitting sun; nor does it scarcely ever happen otherwise, except in winter."

Lib. 7. Cap. 30.

Mead and the author of *Traité de la peste* have cited this opinion with approbation. By the words of Pliny "a meridianis partibus, ad occasum solis," must mean from Egypt and the Barbary coast, towards Italy, Gaul and the other western parts of Europe.

From these facts, is inferred a strong argument in favor of the propagation of that disease by contagion.

With deference to these great authorities, not one of these assertions is accurate. That the plague generally appears first in sea-ports, is a just remark, and according to the laws of nature, it must be so, without infection. But to this rule there are many exceptions. The general plague in the days of Thucydides originated in Ethiopia, near the borders of upper Egypt, *not a sea-port*.

The violent plague in 252 began in the same region; as did that of 1736.

The plague of 542 began in Lower Egypt, between Pelusium and a morass, called the Serbonian bog, at a distance from the port of Pelusium. It should have been mentioned that the mortal plague in the reign of the Antonines began in Seleucia, on the Tigris, far from the sea. The black pestilence of 1348 originated in China. That of 1450 in some parts of Asia. The pestilence of 1348 began, when it first appeared in France, in Avignon, *not a sea-port*; as did that of 1482. The plague of 1575 in Italy, began at the northward, in Trent, and proceeded southward, contrary to the assertion of Pliny; and every one

sknow Trent is not a maritime place. The plague in Holland in 1663, began in Heusden, *not* a sea-port, but on a river and near a morass. In 1702, a plague broke out in Poland, far from the sea.

With respect to the United States, the assertion of the College of Physicians must stand or fall, according to the definition of the fevers which have appeared in the country. If no pestilence has ever appeared, except in sea-ports, we must affix some other name to the mortal epidemics that visit the interior of our country. Certain it is, contrary to the statement of the College of Physicians, that the true yellow fever, and so called at the time, prevailed in Albany in 1746.

About the marshes in the interior of our country, an epidemic bilious fever has times without number, raged as fatally, as ever it did in Philadelphia, destroying life in three or four days, attended with all the characteristic symptoms of yellow fever and carrying off almost every person, within the region of its atmosphere. This has happened, about some of the lakes in the state of New-York, every year since the present pestilential period commenced, and whole villages have been depopulated. If the College of Physicians choose not to call this disease yellow fever, I cannot help it; but sure I am, if it is not that specific disorder, it is one equally desolating, and as little entitled to be fathered on the country, as any species of plague whatever. It is a fact also that the bodies of those who perish by that fever near rivers and lakes, are, if possible, more yellow than in cities.

But what utterly disproves the assertion of the College of Physicians, is, that the same pestilential distemper which has lately afflicted our cities, appeared among the aborigines of this country, before it was settled by the English, before the West-Indies were settled by the English or French, and before a single vessel from the islands had ever reached our shores. To confirm this fact, it is well known that the same disease has often visited them, since the English settlements, and in situations and under circumstances, when it was not possible for them to receive it from infection, as at Nantucket and Martha's Vineyard in 1763, and several times, in the limits of the present state of Rhode-Island.

The Onondagoes in the state of New-York, three or four hundred miles from a sea-port, about eighty years ago, were attacked with pestilence, which wasted the tribe; and the place where their village was then built, has, on the account of that mortality, been ever since abandoned, and is now overgrown with trees. The same happened among the Senecas at a later period.

What the disease among the Onondagoes was, I am not informed; it might have been the small-pox; but the country where it happened, is now subject to mortal bilious epidemics, which kill in three days, and turn the body as yellow as saffron. Besides the great plague of 1618 is known to have been the true infectious yellow fever, and so was the fever of Nantucket in 1763, neither of which could possibly have been imported.

About sixty years ago, a great mortality happened among the Indians, on the north east of a small stream, a little south of East-Greenwich, in the state of Rhode-Island. The disease was fatal to almost all who were affected; but it was local, and infectious, for a law was passed that no person should go from one side of the river to the other, and the Indians on the opposite side remained in health. This place was no sea-port, but an Indian hamlet; and no pretence of importation is suggested, nor does it appear, that any whites were affected.

About twenty-six years ago, a malignant bilious fever attacked the Indians, at Quidnesset neck, in North-Kingston, in the same state, and most who were seized, perished. It attacked also a few families of whites, but with less mortality. North-Kingston is a sea-port, but there is no suggestion of foreign origin.

M. S. of Moses Brown of Providence.

From these facts let the public judge how little reliance can be placed on general assertions even of learned and respectable societies, when made without a critical examination of the subject.

It is proper that I should here take notice of an assertion, found in a number of authors. "That Thucydides relates the plague, in his days, to have spread from Ethiopia by means of contagion, infection or fomites." The learned Diemerbroeck has fallen into this mistake. p. 48.

Galen is more correct, when he says; that pestilence spread by the corruption or infection of the air. This idea, tho not

the expression, is accurate. The truth is, Thucydides does not say, the distemper spread by infection or contagion. A literal translation from the Greek is as follows. "It began as it is reported, first from Ethiopia, above Egypt; then it fell on Egypt and Lybia, and a great part of the King's dominions (Persia.) It then suddenly invaded the city of Athens and first the Piræus." In the paragraph preceding he says, the disease had prevailed in many regions first and especially at Lemnos; but does not hint at infection or contagion as the cause.

The observation of Pliny, that pestilence originates in southern climates and proceeds northward and westward, is generally, but not always true. Alexander Russel tells us, the pestilence in Aleppo in 1719 came from the northward; and many authors relate that it appears in Constantinople or Smyrna, before it does in Egypt. This may be partly owing to alterations in the Turkish cities, since Pliny's time.

But on just principles, the fact is rationally explained. If a particular state of air, favorable to the propagation of that distemper, must exist, before it can become epidemic, which is admitted by the friends and foes of contagion, then supposing this general pestilential principle to exist, at a given time, in equal force, all over the earth, or any portion of it; it must follow inevitably, that this general cause will produce the worst diseases *first* in climates and situations, where the most powerful *local* causes exist, as heat, moisture, and all kinds of deleterious exhalations. And for a most obvious reason; the debility of the human body must be first induced in those situations.

This is a complete solution of the fact mentioned by Pliny; and he himself justifies this explanation of it, for he excepts from his own general rule, the pestilence that appears in winter, a circumstance passed over by Mead. Now the reason why a plague beginning in winter does not follow the course of one beginning in summer, but appears sometimes in northern climates *first*, is, that such a pestilence does not require the aid of contingent causes, as noxious exhalations. It is independent of *local* causes, and induced solely by the essential qualities of the atmosphere; it may therefore appear first in any place or climate



whatever, according to that state of air. This happens only in great plagues which seldom occur.

These observations apply also to the objection that pestilence first appears in maritime places, as mentioned by Procopius, and others.

It is a fact known to every medical man that humidity is a cause of debility. Hear what the learned Zimmerman says on this point.

On Physic, vol. 2. p. 100.

"The humidity of air weakens a man suddenly; it relaxes the solids, and of course weakens the circulation, so that the secretions are carried on with difficulty. The insensible perspiration is checked, the moisture passes in through the absorbing pores of the skin, and the patient feels a lassitude and heaviness, which deprive him of all his gaiety, and render the mind as oppressed as the body"—"Damp situations are, in every country, unhealthy."

p. 101.

There is not a person living who cannot testify to the truth of these remarks. Hence the languor which depresses man, in a hot sultry day, with a southerly light air, *loaded with vapor*. Hence this state of the air, when of long continuance, never fails to generate epidemic disorders; and if it occurs, during a pestilential constitution, mankind seldom escape the ravages of the plague.

It may be said that the inhabitants of maritime towns, are less exposed to this source of debility, than seamen, who are in general remarkably healthy. To which I answer, that the ordinary moisture from sea air never of itself produces diseases; and at sea, there exists no exciting cause, as morbid exhalations, unless in ships of war and crowded transports, in which diseases often proceed from human effluvia. But I question whether the bodies of seamen possess the same firm texture as those of laboring farmers in the country. Certain it is, that seamen are in general not so long-lived men, as farmers. This is ascribed to their irregular and severe fatigue; but I suspect it more owing to the incessant operation of the debilitating powers of moisture.

Whatever may be in this, it is certain that moisture of *itself* in-

duces debility, in a greater or less degree, tho not disease; but when its action on the system is combined with the operation of morbid exhalations, which abound in cities, especially near navigable water, together with the frequent alternations of heat and cold, occasioned by the contiguity of land and water; we are not to be surpris'd that cities on the borders of the ocean, and the banks of rivers, are the first to be attacked with pestilence. We might, without the aid of facts, prove a priori, that this must generally be the case.

Hodges mentions that the London plague of 1665 spread into the adjacent country, *especially along the Thames*; but he takes care to ascribe this to infected goods, and not to humidity—a another proof of the mischiefs of theory.

Indeed the circumstance that next to large maritime cities, the towns situated on the borders of rivers or lakes, are the most severely harrassed with epidemics of a fatal kind, especially autumnal diseases, is an evidence of the truth of the same principle. Wherever we turn our eyes, we see autumnal diseases, from simple tertians to the plague, most frequent and most deadly, in low situations, under the combined operation of heat, moisture and different species of noxious exhalations. It is therefore as unphilosophical to deduce, from this fact, arguments in favor of the foreign origin of the plague, as in favor of the importation of many other malignant diseases; for the same phenomena attend them all—they all appear *first*, and are most epidemic and fatal, in the vicinity of water. This is their general rule, to which exist some exceptions, as well in regard to the plague, as to other bilious complaints.

But the discovery of a general pestilential principle, extending over a whole hemisphere, or the whole globe nearly at the same time, or with a rapid progression, solves all the difficulties on this subject. Had Pliny known, that at the moment a severe plague appears in Egypt, the diseases of all Europe, or all the world, assume unusual malignancy, or other contagious and infectious epidemics appear, in every quarter, to the distance of a thousand leagues, his remark would have been equally just, as to the origin and progress of the plague, but it would have opened to him new causes of its origin, and a more just and philosoph-

ical view of the phenomena. This is a discovery which prostrates all theories of specific contagion, and reduces the influence of infection to its just measure.

Another fact. Forestus has declared that in pestilence, three times the number died in wet weather, as in fair and dry weather; the infection being less easily dispersed, in wet weather, which is evident from the smoke of chimnies.

Van Swieten, vol. 16. 26.

It is well known in America, that while the weather is hot, rains and moist air greatly multiply cases of pestilential fever.

In 1720 a storm of thunder and lightning at Marseilles, late in July, was followed by a great increase of the plague.

Traité de la peste.

Every one knows that the air, along the borders of the ocean, corrodes iron and other metallic substances. Is it not then questionable whether the saline acid, which impregnates the maritime air, has not some deleterious effect on the human body, when combined with other vapors from the earth? Are we yet acquainted with the essential properties of all the possible combinations of aerial substances?

Again; Mead has remarked, that countries and cities which have had most commerce with Africa, as Marseilles, have been most frequently afflicted with the plague. A French author, he says, reckons 20 plagues that have infested Marseilles, notwithstanding its healthy situation.

In opposition to this, it may be proved by facts, that the cities, in the interior of Germany, that never had any trade or connection with Egypt, used formerly to be harrassed with that disease, nearly, if not quite as often as the maritime ports of England, France, Spain or Italy. Any man will learn this, who reads the whole history of that calamity, instead of that of a few detached instances.

As to the twenty plagues of Marseilles, ascribed to the trade with Egypt, I would observe, that I can produce the history of near double that number of violent plagues in London, before that city had any trade or connection with Egypt.

Equally ill founded is the idea of medical writers that the yellow fever of the West-Indies was brought first from Siam. "Mal-

adie de Siam," is the name given to it by French physicians; and this improper name, will serve to perpetuate the error, while it shall exist as a monument of ignorance and false philosophy. This pretended Siam fever was the pestilence of the Indians, on this continent, before the West-India Islands were settled by the French or English.

Another extraordinary assertion of Mead, is, that "the northern nations of Europe, before their connection with Africa in trade, grew populous more rapidly, than in modern times."

I will not contest the assertion, as it regards the degree of population of those countries, in different periods. Authors differ in opinion on the subject of the ancient population of Europe, and no certain documents or facts exist by which the point can be ascertained.

But the implication necessarily deduced from Mead's assertion, is, that the plague is more frequent and destructive in the north of Europe, since a trade has been opened with Egypt, than before; for on this principle only would he account for the reduced population of modern times. If this is what he meant to insinuate, the assertion is not simply inaccurate, but absolutely false. From the first accounts we have of Russia, Poland and the Baltic regions, to the first opening of a trade with Egypt, in modern days, plagues were much *more frequent* and fatal in those countries than they have been, within the last century, since a constant trade has been carried on with Egypt and every part of the Levant. For the truth of this assertion, I appeal to facts.—In the year 1485, the English first opened a trade to the Mediterranean, especially with Italy, and a consul was appointed, resident at Pisa. The act of appointment by Richard 3d. contains this passage "whereas certain merchants and others, from England, *intend* to frequent foreign parts, and chiefly Italy, with their ships and merchandize"—Before this, England had little or no trade, *directly* with foreign countries. All her trade was conducted by Lombards, Genoese, Venetians and the Hansemerchants. There was no direct trade to Egypt and the Levant.

About the year 1511, English ships began to frequent Sicily, Candia, Chios and the Syrian coast; but this was accounted a



very hazardous voyage, and ships seldom made it in less than a year.

In 1535 English factors first settled in those countries.

See Anderson's Commerce, vol. 1. 683. vol. 2. 79.

Rymer's Fœdera, vol. 12. 261, and Hackluis Voyages, vol. 2. 96.

Now, the fact is, that the plague was as frequent and severe in England, Denmark, Sweden and Germany, in the tenth, eleventh, twelfth and thirteenth centuries, before any foreign trade existed, as in any later period. Not to mention the universal plague in the days of Vortigern, about 448, which never has been exceeded in extent and violence, unless by the black pestilence of 1348.

The Levant Company was first established by Queen Elizabeth in 1581, and the act of incorporation expressly states that "Sir Edward Osborn and his associates, the persons incorporated, had at their own great costs and charges, *found out and opened* a trade to Turkey." Before that time the commodities of Egypt, Syria and Turkey were all imported from Italy, in Venetian or Genoese ships.

The commerce of the North of Europe from the year 1200 to 1500, was almost wholly in the hands of the Hanseatic Confederacy; but on careful investigation, I cannot find the least trace of a direct trade to the Levant, by the towns in that league. Indeed before the discovery of the mariner's compass, in the 14th century, all trade was carried on by coasting. History records more than one hundred general plagues before that discovery. So totally false is the assertion of Mead.

But say the College of Physicians, in the memorial before cited, "proper health laws, strictly enforced, have latterly protected the commercial parts of Europe from its ravages." This is a point of importance, and while the assertion stands unsupported by proofs, I am at liberty to deny the truth of it, and there leave the question, as fair on one side as the other; for I cannot prove a negative. If however health laws have produced the effect alleged, it is very strange that the plague did not disappear at a much earlier period.

The institution of health laws was as early as 1484, and it appears they were first introduced at Venice. If these laws have

ever prevented an epidemic plague, it is very strange, that they were ineffectual in Venice and other parts of Italy, for near two hundred years, as they certainly were. It is indeed wonderful that, during the 16th century when all Europe was almost continually ravaged by that disease, and down to the close of the last century, no man could be found to devise a law, and no police, to enforce it, so as to arrest the progress of the plague in Italy. Yet such was the fact.

The first statute, I believe, in England to restrain the progress of infection, was in 1604, in the first session of James I. 31. The regulations attempted by the proclamation of Queen Elizabeth in 1580, before recited, prohibiting the enlargement of London, and the residence of more families than one in the same house, could not, from the tenor of them, be carried into effect. The statute of James limits its provisions to the confinement of the sick to their houses, a breach of which was made felony. An enforcement was attempted in the subsequent plagues, and especially in 1665, but without the least good effect, as to the city at large, and with a very ill effect upon the diseased and their families. It is certain however that a strict execution of such a law, would arrest the progress of *infection*, for the infection of the plague is found and admitted on all hands to be confined to contact or very near approach, so as to be received by the breath of the diseased. If therefore the disease were propagated by infection only, such confinement of the sick would check its progress, if not annihilate it. We know by repeated experience in America, that there is not the least difficulty in putting an end to a disease arising solely from specific contagion; and it has often been done in cases of the small-pox. Hence the inefficacy of the law of James I. after repeated trials in the plague, is a strong evidence that its propagation depends on some other cause than infection.

From 1604, to the reign of Queen Anne, no general laws were enacted on this subject, as far as I can discover from the printed statutes. In the 9th year of Queen Anne, 1709, passed the first statute enjoining vessels to perform quarantine; at least I can find none earlier. This was repeated by 26th,

George 2, 1752, a new statute on the subject, which was afterwards amended by the 29th of the same reign. Now it so happens, that the plague ceased in London in 1666, forty-three years *before* a general quarantine was instituted. Particular laws had been passed before, on emergencies, as in 1664, when all importation of goods from Holland, was prohibited, on account of the plague, then in Holland; but without effect. The truth then, is, so far as regards Great-Britain, now the most commercial country on earth, and at the time in question, the most commercial, next to Holland, the plague entirely ceased and disappeared, 43 years before the existence of quarantine laws. If any mistake occurs in this statement, it must proceed from want of materials—my enquiries are limited to Blackstone and the printed statutes at large, the only documents I possess on that subject.

In the course of my reading, I have found but two or three instances, in which it has ever been *supposed* that health laws have preserved a city from pestilence. Mead mentions two instances; one at Ferrara in 1630, where every person, seized with the disorder, was immediately removed to a Lazaretto; which being done in seven or eight instances, the disease was checked and disappeared.

Another instance he mentions was at Rome in 1657, where the persons first seized were removed to Lazarettos and their families to hospitals without the city, and the city was soon freed from the disorder. He supposes further that the disease was suspended a whole fortnight in Marseilles, in 1720, by the same means.

I have no account before me of the origin and progress of the plague, in Italy, 1630 and 1657, except the sketches found in Mead's works, but wherever I can obtain a correct account of this disease, mentioned also by Mead, I find his statements are imperfect and erroneous; I therefore place very little dependence on them. That the plague in Marseilles was stopped a fortnight by regulations of policy, is not true. The disease appeared in the preceding autumn, and was suspended five or six months by the winter. When it appeared in the month of May 1720, wri-

ters say, the first cases were among those who had intercourse with the ship and goods from Said ; but all those goods were prohibited to be carried into the city, and subjected to fifteen days retreat and purification. The porters who had concern with them were confined. Some weeks after, in the month of June, cases of the disease appeared in the city ; all precautions had proved fruitless ; as the hot weather came on, the disease started up here and there in the city, among persons who never had any concern with the ship or the goods, or the infected ; it then subsided ; then again appeared, in the manner before related.

Whether the persons seized in May contracted the disease from the goods or foul air of the ship, or not, is not material ; for the goods were cleansed, and all the diseased confined to the hospital, and all the porters shut out from the city. Yet when the disease appeared in the city, no person could tell how it came there ; many were seized who had never been near infection ; and hence the populace resort to supposition to account for its origin—they *suppose* the disease had come from the goods after they were cleansed, tho they had no evidence of it. Besides I have before remarked under the year 1720, that the goods could not be infected, for it is admitted on all hands that they were shipped at Said, when the disease was *not* in that port. The ship's hold might have generated foul air on her passage, and the first persons connected with her might have contracted a pestilence from that air, which is not an uncommon thing, in such a very sickly period, as that was, when mortality was increased all over Europe and America. But the truth is, had that air been the cause of the plague in the city, the disease would not have been suspended for six weeks, but would have made a regular progress from one patient to another. But no ; it disappears for six weeks, and then breaks out in parts of the city remote from the supposed source of infection, and among people who had not been near that source. So inaccurate and inconsistent appear all accounts of the contraction of epidemic diseases from fomites, which I have been able to investigate by full and authentic documents. This shows how little reliance we can place on partial statements, made to support favorite systems. I therefore am persuaded that



the cases mentioned by Mead of the effectual restraint of the plague in Italy by removing the sick, are not fully stated, and that an accurate enquiry would prove the supposed effect to result from other causes.

The following facts will furnish a more rational solution of the phenomenon.

In the United States, ever since the commencement of the present constitution of air, that is, from 1790, sporadic cases of our pestilential fever have occurred, not only in cities, but in various parts of the country, more or less, every summer and autumn. In 1792 occurred a number in New-York; also in 1794 when one case exhibited infection; and in 1797. Of about thirty cases perhaps, in each year, some of them were excessively violent, highly marked, and in a degree, infectious. In 1791 and in 1796, several hundred cases appeared, yet the disease was not epidemic, but local, and the business of the city was not suspended. Now had every person, the moment of his seizure, been conveyed out of the city to a hospital, the escape of the city, in each of these years, would vulgarly have been ascribed to that circumstance. This was doubtless the case in Ferrara and Rome, and this is unquestionably the solution of the fact, that the cases in the Italian cities, were sporadic cases, which always occur in the neighborhood of the plague. This disease, in the years mentioned, raged in other parts of Italy; the cases mentioned by Mead were sporadic cases, indicating a pestilential constitution of air, extending to those cities, but of a less malignancy, and too mild to produce a general pestilence in those places; it affected only a few persons of habits most susceptible of it; and to these it probably would have been limited, had none of them been removed.

A similar fact occurred in Philadelphia in 1794. Eighty or a hundred persons died that year of the true yellow fever; none of them were removed; but to these was limited the operation of the pestilential principles, local and general; and no epidemic ensued.

In New-London a case occurred in 1795; and in 1796 several cases of the same disease; but no epidemic, altho no removal of the sick took place.

In Providence, sporadic cases have occurred almost every year, with symptoms of the infectious yellow fever. In 1791, in June, died two daughters of a widow, in the center of the town. They vomited bilious matter, and their bodies were yellow, with livid and purple spots. Other cases occurred the same year; one case in 1792, and a number in 1793, 4 and 5; cases which could not possibly have originated from foreign sources. Some of them appeared to be infectious, as that of the young women first mentioned, the first being taken on the 4th of June and dying on the 7th; the second being seized on the 9th, and dying on the twelfth. Yet no epidemic followed; and had these patients been removed to a distant hospital, the safety of the town would have been ascribed to that removal, and the salutary effect of health laws would, by Mead's followers, have been trumpeted over the country, and what is worse, would have been recorded as an important fact, which would hereafter mislead posterity.

Nothing is more dangerous than to build a theory, or to establish a general principle on a few detached facts, inaccurately stated, and ill-understood.

With regard to the case of Rome stated by Mead, it must be observed, that the disease had, in the preceding year, killed 10,000 of its inhabitants, and in the kingdom of Naples 400,000. The disease had probably finished its course in that region, and the few cases in Rome in 1657, were only detached instances, the remains of the pestilential cause; such as occurred in London in 1666, after the fatal plague of the preceding year. It is by no means probable that the disease, if neglected, would have become epidemic.

But we have stronger ground to oppose the idea of the College of Physicians, relative to the effect of health laws. Numerous examples are on record, in which the full force of the best regulations to prevent pestilence, has been applied in vain; and since the publication of the memorial of the College, from which this idea is taken, Philadelphia has witnessed the futility of such regulations, in two melancholy instances.

In 1636, the law to prevent infection was rigorously executed in London; the sick were confined, suspected families were se-

questered; but all to no purpose; the disease spread, the legal restrictions were then taken off, and no ill effect followed; the distemper spread no faster than before.

In 1665, the same regulations were tried in vain; and so was the law, prohibiting the importation of goods from Holland.

The approach of pestilence towards Dantzick in 1708, in which year it appeared at Thorn, alarmed the magistrates of the former city, and every possible precaution was used to prevent its reaching Dantzick. Commerce and communication with infected and suspected places were forbidden; no sorts of merchandize, especially those which are most apt to retain infection, were permitted to enter the city from such infected places; all strangers and travellers were strictly examined, and none suffered to enter the city, without sufficient proof of coming from healthy places; all the inhabitants were cautioned not to hold correspondence with infected places, nor to harbor those who came from them. These and other regulations were enjoined by an edict in July 1708. Yet all to no purpose; the plague appeared at Dantzick, the next spring.

*Baddam's Memoirs, vol. 6. p. 6.*

This is a remarkable instance of the futility of human regulations, when opposed to the laws of the physical world. The people of Dantzick, had they been acquainted with the principles of pestilence, might have foreseen in 1708, the probability of the inefficacy of their regulations. The state of the air in the production of millions of spiders, and the increasing mortality in the city, indicated the existence of a state of the air, unfriendly to health, which was increasing and only required a little more virulence to generate the evil, which they ignorantly supposed must come in sick bodies, goods or old clothes; and which they were idly combatting on that mistaken principle.

It has already been stated that the rigorous execution of health laws at Marseilles in 1720, proved utterly fruitless.

The plague which desolated Naples in 1656 was said to be introduced into that city by soldiers from Sardinia, where it raged the preceding year. Yet the Viceroy, Count Castrillo had prohibited all intercourse with Sardinia. After the disease appeared which was first in the form of a malignant fever, without

glandular tumors, all possible means were used to prevent its spreading, but to no purpose.

The confidence in modern health laws, is like the respect which the ancient Egyptians paid to the bird, Ibis, which, they supposed, averted the plague by destroying the flying serpents that the hot Lybian winds brought into the country.

Cicero de Nat. Deor. lib. i. 36.

The Egyptians were like all modern nations—unwilling to believe the plague generated at home—they ascribed it to infection brought by flying serpents, as the moderns ascribe it to old clothes, bales of goods and infected ships. They mistook the cause, adored Ibis, as the moderns do, quarantine, and with the same ill success.

But we need not step off of our own territories to find evidence of the inefficacy of health laws, when opposed to the operation of the laws of nature. No expedient has been left untried to ward off the calamity of pestilence, but without any visible effect. The severity of the affliction in Philadelphia, in former years, had rendered the magistracy of the city extremely careful to guard against importation in 1798. The most rigid quarantine was exacted—ventilators of the best construction employed—the vessels were washed, fumigated, white-washed with lime, and every practicable mode of purification adopted. Not a vessel was suffered to approach the city, without satisfactory evidence of the healthy state of the people, and the salubrity of the vessel and cargo. See the letter from Hillary Baker, Esq. mayor of the city, to the mayor of Baltimore, dated August 13th, 1798. Alas! all to no purpose! The ravages of the disease are well known.

If, says the late worthy mayor, the disease has eluded the health officers, I shall despair of future success, unless the West-India commerce shall be prohibited in the summer months, and magazines established below for receiving the cargoes.

Similar provisions in other ports have been established with no better success. The health laws at New-York, so far as appears, were as well executed in 1795, 96 and 98, when the fever was epidemic, as in 1794 and 97 when it was not. No visible good effects are to be discovered in guarding against an epidemic; the



utility of cleansing vessels therefore is limited to guarding against the operation of infection, upon a few persons who may enter them, with foul air on board. Public health, so far as can be discovered, has never been secured by those regulations. What seems to place this point beyond question is, that for thirty years preceding 1792, no pestilential fever ever spread in America, from the ten thousand infected seamen and passengers, which arrived in the country from the West-Indies, and during which time, in most places, not the least precaution was ever used to guard against it; yet since 1792, that is, under a state of air, generating various epidemics, the pestilential fever has appeared in sporadic cases, every year and in almost every town in America, and has raged as an epidemic in most of our large towns, in opposition to the utmost efforts of human skill. I am persuaded, the conclusions from these facts amount to demonstrative evidence, that infection is *not* the principal, or cause sine qua non, of this terrible calamity.

The application of quarantine laws to our epidemic pestilential fever, is just as useless, as the order of the Sultan, Achmet I. in the wasting plague of 1613, for transporting all the cats in Constantinople to the island of Scutari. The Jewish physicians told the Emperor, that the plague was occasioned by the cats, and the poor cats were dispatched into exile. Yet this did not restrain the plague.

People have been forever mistaking the cause of the plague. In the first centuries of the christian era, when disputes ran high between Christians and Pagans, these sects mutually charged the plague each to the other. In 1349, the Germans ascribed the plague to the Jews, and massacred great numbers of that race. In Paris, during a plague, many protestant *heretics* were sacrificed, for bringing the calamity upon that city. And a proposition has been made in America to stop all intercourse with the West-Indies and the Mediterranean, during the summer months! Astonishing blindness!

But, it will be asked, shall we have no health laws? I answer, by all means. Their utility is obvious on many occasions. Thus when an infected fleet arrives in a port, the town is in imminent

danger, of what may be called a jail fever on a great scale. The quantity and virulence of infection thus imported, have produced destructive consequences, as at Brest in 1757, where were landed in November and placed in hospitals, about five thousand diseased seamen and troops from ships, mostly out of De la Motte's fleet, from Louisburg, with a malignant fever on board. The effect was that ten thousand men died, in the hospitals, the succeeding winter, and many of the inhabitants of Brest. But it will be remarked, that this infectious disease did not become an epidemic in Brest; it spread only by infection; and as soon as that was dissipated, the disease disappeared. It raged in winter and subsided in spring. This is an important distinction, always to be observed by those who guard the public health—an epidemic pestilence begins when the season or the state of air favors it, and rages without control, against all human efforts; the common air becomes tainted, so as to produce the disease, without the infecting principle from bodies or clothes, and the diseases subside only at the command of the seasons and the elements. Against such, no legal provisions are or can be of any avail, and such is usually the yellow fever of our country.

But diseases propagated only by infection, like the jail and ship fever, never put on the form of an epidemic. They rage in crowded prisons and ships, where they are generated; and when multitudes are crowded into hospitals, they carry the evil with them; and all persons, coming within reach of the infection, are liable to suffer. In this manner, Brest lost many of her inhabitants; a town in America is said to have done the same, from the yellow fever, imported in Sir Francis Wheeler's fleet, as already related. But in such cases, the infecting disease requires contact or near approach to aid its propagation; and does not assume the complexion of an epidemic. The two species of disease are as distinguishable as light from darkness.

Thus, at the Black affizes in Oxford, in 1577, a malignant or jail fever of a singular kind, was produced suddenly—almost all the court and spectators were seized—many died—but no epidemic followed in Oxford; and in this instance, the effect was so sudden, that the human body did not generate infection.

So also at the Old Bailey, not many years past, a few prisoners, entering the court from a dirty jail, without changing their dress, infected a large number of persons who died; but no epidemic followed—the infection was soon dissipated, and there was an end of the disease.

With our pestilential fever, this is not the case, nor with any epidemic plague that ever existed. Remove the sick, cleanse the houses and clothes, do whatever human art and labor is competent to effect, all will not avail—cases spring up in every quarter, and the disease takes its course.

So it was in Candia in 1592, as related from Thuanus, under that year. As soon as the plague appeared, all the sick and all the suspected were removed from the city; but to no purpose; it raged till July—then abated without any human means and revived again in October.

Thus says the author of *Traité de la peste*, “Universal cleanings have proved useless; the plague has ravaged places after every precaution; and after negligence it has entirely ceased, as in Naples.”

Such are the facts, and hence the necessity of distinguishing carefully between *epidemic* pestilence, proceeding principally from general causes in the elements, and marked by other epidemic diseases, by the failure of vegetable productions and by the sickness, or death of cattle, fish and other animals—and *diseases merely infectious*, generated by artificial means, which may be communicated, which may happen in jails, ships and camps, in the healthiest state of the elements, and which cease, as soon as the infection can be dissipated by purifications and fresh air. Without this distinction, the merit of legislative and police-regulations, can never be duly appreciated. Such regulations, applied to *epidemics*, as they continually are, prove totally futile—applied to diseases of mere infection and of specific contagion, as jail fever and small pox, they may be and often are the means of preserving multitudes of lives.

It is important therefore that health laws should be judiciously framed and strictly executed, because there may be cases in which public health will be preserved by them; altho' they never can

reach the cause or prevent the ravages of epidemics, which originate where they exist.

With respect to merchant-men, health-laws may also be of some use, in preserving the lives of seamen, and of persons concerned in the vessels. Sick men may generate a small degree of infection; but on board of merchant-men, the number of seamen is too small to infect a ship, so as to endanger public health, unless shamefully neglected.

The most danger from merchant-men is from the foul air generated, on long voyages and in hot seasons, from perishable and fermenting substances. From such vitiated air, deprived of its vital principle, great danger may arise to the persons who first open and enter the holds; and perhaps to a neighborhood. It is of great consequence therefore to use ventilators freely on board of vessels, freighted with perishable articles; and to have them effectually cleansed, before they are suffered to approach our wharves.

But I am not convinced that the air of such vessels ever yet originated an epidemic fever. It appears to me, that the Academy of Medicine in Philadelphia, lay more stress on this cause, than it deserves. The sphere of the operation of such a small morbid cause, cannot be extensive; and all the foul air of the largest vessel must be so attenuated by diffusion, as not to produce deleterious effects, at any great distance. It may be injurious to a small neighborhood; but I do not conceive it possible, that the noxious air of a few square yards, can impregnate the whole atmosphere of a city; and as to infection from the sick, I have repeatedly proved, that this can never produce an epidemic. I will admit the *bare possibility*, that imported infection may enkindle the flame of pestilence, in a place fitted for it by local causes, where no pestilence would appear without a spark from infection. This is as much as I can admit to be possible, and more than I believe; after a more minute and careful investigation of facts probably, than was ever before made in America. Most of the cases I can find, where accurate accounts are preserved, of supposed importation or communication of autumnal diseases, fail utterly of proofs to support common opinion; and

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many of them are incontrovertibly proved to have had their origin in the places where they have existed.

It is easy, I aver, to distinguish, in every case, the nature of pestilence; that is, whether it is an epidemic, proceeding from a state of the elements, or a disease generated solely by foul air, artificially collected. In a few weeks, if not a few days, a disease will show whether it proceeds from infection only or from a general elemental source; and when it appears to proceed from the elements, men may just as well attempt to save the cats, the wild animals or the fish in the ocean from the effects of that principle, as their own species, by laws enjoining quarantine and purification of ships. The same cause that destroys the cats or the fish in one case, destroys human life in the other; and that cause exists in the elements; it is at home; quarantine laws do not reach it.

An epidemic disease may be distinguished from a disease proceeding from infection or specific contagion, by the following circumstances.

1st. An epidemic pestilence is preceded by influenza, affections of the throat, or acute and malignant fevers.

2d. An epidemic predominates over other diseases; totally absorbing them or compelling them to assume its characteristic symptoms. This last circumstance is decisive of the character of the disease.

A disease propagated by contagion or infection only is not thus distinguished. It has no precursors, it extends and spreads only by contact or near approach; and has no effect on the diseases in its vicinity. The small pox or jail fever, depending on mere infection, never expel a dysentery or intermitting fever.

In every possible case, a plague that banishes other diseases, as I believe it always does, is an epidemic generated in the place where it exists; for it is not possible that this expulsion of other diseases, could take place, unless the epidemic depended solely on the elements. Simple infection would not change the symptoms of another disease, even in the next house, much less in all parts of a city.

To show how little an epidemic depends on infection, let us advert to facts. In all the eastern countries, the plague is suffer-

ed to take its own course without restraint. There are no regulations to control its progress, or prevent its return. Its beginning is usually gradual; a few die the first year; the proper season suspends its progress; the next year it is more general, and often, the third year is the most fatal.

It is remarkable, that after its most extensive effects, it abates and suddenly disappears. In London, the malignant precursors of the plague of 1665, appeared as early as 1661; but no sooner had its crisis passed, than in a few months, it was totally extinguished. The same happened at Aleppo in 1762, and such is usually the fact.

Let any man suppose the disease to be propagated wholly or mostly by infection, and attend to the consequences. In Aleppo, says Russel, died 500, in 1760; in 1761, died 7000, and in 1762, 11,000. On the principle of infection then, some sick man, or a bundle of old clothes, first spreads the disease, so as to destroy 500 lives—the infection of 500, destroys 7000 lives, the infection of 7000, destroys 11,000 lives; and the next year, the infection of 11,000 destroys—none at all!

In London, a few bales of cotton, smuggled into the city from Holland, in 1664, communicated infection that destroyed 68,000 lives; the infection from this immense number proves fatal, the next year, to 1900 only; and these, the year following, infect only 35! If infection has much concern in propagating that disease, its operation certainly defeats all arithmetical calculation of its physical powers!

The whole theory of infection, to which Mead has given so much celebrity, and which is maintained by many physicians in this country, is absurd and ridiculous from first to last; leading legislators, magistrates and citizens astray from the truth, producing most serious inconveniences to commerce, and preventing the adoption of the only means of mitigating the pestilence to which our cities are exposed.

In Turkey and Egypt no pains are taken to cleanse houses or clothes after a plague. No sooner has a great plague ceased, which has cut off 300,000 people in Constantinople or Cairo, than the infected houses are filled by other people, who replace the dead, use the furniture and the bedding on which the infected

had died ; or the old clothes are sent to auction and purchased by Jews, who retail them out for use, uncleansed ; and yet amidst all this mass of concentrated infection, no person has the plague, or if a sporadic case occurs here and there, no epidemic ensues, for two, three or four years, perhaps longer ; then all at once, when the infection must necessarily be destroyed, by the action of air and water, the disease breaks out again, and becomes epidemic. Then some arrival from an infected place is hunted out, and the calamity is charged to the account of some poor sick seaman, or his clothes ! The infection of half a million of people, produces no plague in one year ; but in another, the invisible fomes of a piece of cloth, or the breath of a single man is sufficient to spread desolation over a great city, or a kingdom !

Such are the absurdities of the modern notions about the plague, which adorn this splendid era of philosophy and science !

Of the nature of the infecting principle in diseases, we know very little ; and even its effects are not always comprehensible. We observe differences also in the operation of the principle, which we cannot explain. Why the small-pox should be communicated, under *all* circumstances ; the plague only under certain circumstances, is a mystery not yet unfolded. It is supposed, that the diseased body discharges certain fine poisonous particles, which are suspended and diffused in the air, and being imbibed by the pores of the skin, and with the breath, excite the same species of distemper in a healthy body. These effluvia generally escape our sight and very often our other senses ; but they may be concentrated in such quantities, as to be very obnoxious to the olfactory organs, and even to excite sudden nausea in the stomach.

But why the effluvia from the small-pox, anginas and the measles should be independent of heat and cold ; and those of dysentery, plague, and other typhus fevers, subject to be excited

\* Hodges informs us, that after the plague in London, in 1665, people returned into houses not cleansed, and even slept in beds on which the infected had died, without fear or injury. This is not at all strange. Unless the effluvia from the sick have been closely confined and are greatly condensed, they will not affect a well person ; and indeed it is a difficult thing to preserve the morbid matter in sufficient quantity to communicate disease in cold weather.

into action by the one, and to be destroyed by the other, is a phenomenon never yet explained. We may say the particles issuing from the former class, are more subtle, volatile, and penetrating; but this is all conjecture. Certain it is, that the poison of small pox, angina and measles, is of a more distinct, specific kind, than that of the plague, less connected, in its operation, with putrid exhalations from other bodies, and less susceptible of grades in its powers.

So far as I am able to comprehend the nature of the infection of plague and other autumnal diseases, passing under the popular name of *putrid*, it appears to consist of a species of air, which is one of the elementary parts of all vegetable and animal substances. It may be what Dr. Mitchell denominates, the *septic acid*; that fluid which is discharged from flesh in the process of putrefaction. It may be some other species; but it is very evident, from all its effects, that it operates, in producing disease, no otherwise than all the morbid exhalations extricated from every species of vegetable and animal substances in the putrefactive process. In all or most of such substances, there is, it is well known, a species of air or acid matter, which, when in a form detached from other substances, is highly noxious to health. To this fluid, or septic acid, evolved from vegetables in a state of natural putrefaction, and floating in an aerial form, is ascribed the whole class of bilious fevers, which prevail near marshes.

Hence, the effluvia from a person laboring under the plague, are susceptible of all degrees of concentration, and in proportion to their concentration, will be their violence, and certainty of effect, when they attach themselves to a healthy body. In this respect, the infection of the plague differs most essentially from that of the small pox. The matter of contagion in the small pox, however small, is sufficient to communicate the disease; and it is customary for physicians to wipe clean the point of a lancet, dipped in variolous matter, before it is inserted in the skin, for the purpose of inoculation. It is also proved by experiments that the quantity of infection introduced by inoculation, whether more or less, makes no material difference in the number of pustles, or violence of the disease.



But in the plague, the operation of infection is very different. This disease, if light, produces no infection, or very little—more violent cases appear to be more apt to be communicated—and in great plagues, the infection is visibly augmented. Yet in most pestilences, an instantaneous exposure to the effluvia from the sick will rarely produce any effect, as in the case of small pox and measles. It usually requires a person to be a considerable time in the room with the sick, in the plague, to receive poisonous air sufficient to excite disease; and more generally, it is not communicated, without handling the sick or imbibing his breath. In many cases, all this exposure for weeks and months together, will excite no disease. Hence Russel represents the plague, as of different degrees of malignity and not always infectious. Hence the propriety of close and indefatigable attention, in pestilence, to every article of cleanliness; for by this means, the quantity of infection is reduced, and the danger diminished, from a high degree down to nothing. Not so, in small-pox and measles, the contagion of which regards not filth or cleanliness.

The infection of the plague, dysentery and the like seems therefore, to be nothing more than an *access of noxious matter, to the local causes, morbid exhalations*. The noxious air of filthy streets, docks and tenements, are secondary and augmenting causes of the plague; when the disease appears, the effluvia from the diseased still *augment* these other local causes. Thus when a certain state of air, in a city generally, will produce a malignant fever, and persons are exposed to it by walking in the streets, a sick person, confined in a close room, will soon fill that room with exhalations from his lungs and pores, which will render that room *more dangerous* to a person in health, than the open street. This seems to be the amount of the infection of plague and other autumnal diseases.

Thus also in a violent plague, the common air of the streets becomes so highly infected, that persons attending the sick cannot possibly determine whether they take the disease from the common atmosphere, or from their intercourse with infected persons. The only cases which afford certainty in this respect, are, when the diseased are removed into the pure air of the country,

and nurses and visitors, who have breathed no pestilential air in the city, are taken ill, in a few days after such intercourse with the sick. These would be clearly the produce of infection. But these cases rarely occur. It has already been observed that the worst cases of pestilence removed into the country, seldom infect the attendants. This shows how little apprehension ought to be excited by mere infection, and how ill-founded are the alarms in the country, about the spreading of the yellow fever; alarms that often occasion a neglect of diseased fugitives from the city. People in the country have little to fear from infection, if the sick are kept in airy rooms and cleanly; they ought not to abandon the sick; for the duties of humanity are not incompatible with their safety. It is the infected ground, if I may so call it, the local atmosphere of pestilence which is to be dreaded, and especially by strangers. During its prevalence, in a city or town, the air of the place is rank poison to persons, accustomed to good air.

The preceding facts and distinctions enable us to form a just estimate of the importance of health laws. In nine cases of ten, in which quarantine is enjoined, human efforts are opposed to the great laws of nature, and are therefore useless. In all cases, where the air of a country exhibits evidences of a pestilential constitution, in an increase of the number and violence of the symptoms of common diseases; in the production of certain epidemics, as catarrh, anginas, measles, petechial fevers and the like; in the death of fish or the unusual diseases of cattle and other animals; in the production of insects, uncommon in size, in kind or numbers; and other remarkable phenomena, before mentioned; in all such cases, the pestilence which invades man will be found to arise solely from the uncontrollable laws of the elements; and quarantine will be utterly unavailing to guard cities against its introduction and ravages. The remedy is not applied to the source of the disease. Hence the efforts of the police in London in the last century, and of Dantzick and Marseilles in this, were entirely useless; and hence the failure of all health laws to save our cities from the late epidemics.

Satisfied as I am of this truth, I would not lay aside the application of these laws. The bare possibility of saving the lives of a few individuals, and especially of diseased seamen, is a good reason for cleansing ships after long voyages, and of purifying their cargoes, when in a bad state. But what I contend for, is, that we must not expect the best health laws, most rigorously executed, will ever be successful in guarding cities against epidemic pestilence. In our reliance on such regulations, we expose ourselves to perpetual disappointment; we expose the lives of citizens; we overlook the true causes of the evil, and neglect the only means of preventing or mitigating its effects.

Further, the opinion of the specific contagion of the plague has originated many, not only useless, but barbarous regulations. Such is the practice of confining the sick to close houses; and still more, of confining the citizens of an infected town within its limits, by an armed force—which I am informed has been done in Europe. In Marseilles, the first persons seized were confined to their houses by the point of the bayonet.

An ignorance of the nature of a disease and its degree of danger, may be pardonable in a prince or the legislators of a free state. But there is a point, beyond which ignorance in medical professors, becomes a crime. No science is necessary however to convince any man, that most pestilences, proceed only from the degraded state of the elements, aided by the morbid exhalations of cities. This is a fact that may be known to a certainty by very little reading and observation. It was well known in past ages, when men were more governed by observation, than by theories and erroneous reasoning. Mead's attempts to prove the specific contagion of plague, aided by his popularity, had a most surprising success; his treatise was received as a standard of truth; it every where suspended enquiries and checked a spirit of investigation, which might have dissipated error; it was the basis of the present laws of quarantine, which are applied, in thousands of cases, where they are as improper and as little wanted, as if applied to prevent an epidemic pleurisy, or head-ache, embarrassing commerce, without the shadow of necessity. But these are not the worst effects. The erroneous system of specific con-

tagion, has mislead mankind into a fatal security, on the subject of the local causes of diseases. Supposing the laws competent to guard public health, men have not attended to the best modes of constructing houses and cities, and to the means of watering and cleansing them—means by which all the slighter pestilences might be avoided, and the more severe ones, greatly mitigated. Hence I am persuaded, that the received theory of specific contagion is the direct cause of most of the fatal plagues that now scourge civilized Europe and America. For it will be observed, that pestilence has always been the *peculiar curse of populous cities*. Of about two hundred general plagues, recorded in history, a few only have been so violent as to spread over countries into villages and farm houses; almost all have been limited to large towns, evidently demonstrating that they would never have affected mankind, without the influence of the impure air generated in those places. This is a truth, as unquestionable as it is important; and on a conviction of this hangs the safety of men from that dreadful calamity. Had Mead, and other eminent physicians taken the same pains to lead mankind into truth, as into error, we should long ago have introduced improvements into the arrangement and structure of our cities, which would have secured our citizens from nine tenths of the infectious diseases, by which they have been alarmed and distressed.

At the same time, had men understood the common operation of infection, which may be made obvious to the most ordinary minds, merchants would not, at this day, have been harrassed with the necessity of performing quarantine, to guard against epidemic diseases. We should not have seen a ship from the West-Indies condemned to the flames, in a British port, because she had lost her crew by the yellow fever; nor merchantmen from an American port obliged to ride quarantine in the British channel, because that disease prevailed in this country. Physicians, had they not been blinded by system, and taken opinions for granted, without enquiry into the grounds on which they rest, would have known before this, that the yellow fever will not spread in England, Scotland or Ireland. It never shows itself



in America, without a much greater degree of heat, than the ordinary summer temperature of those countries. The heat in those latitudes rarely exceeds, for a few hours, in a single day, 75 or at most 78 degrees by Farenheit. But no epidemic yellow fever is ever generated, in our climate, with that degree of heat. In general, we never see cases of that disease in America, until we have had a period of heat rising, for a considerable time, to 85 deg. or higher. In any season of ordinary temperature, the yellow fever, in the British kingdoms, and other parallels of latitude, introduced from abroad by seamen or others from warmer climates, would immediately subside and be extinguished, without any human efforts. The cases of malignant fever in England, which turn the body yellow, and which sometimes occur, as mentioned by Lind, are generated about marshes, in hospitals, camps, ships and prisons. An epidemic yellow fever, like that which prevails in America, was never known in England, and probably cannot exist in the climate. The quarantine enjoined on vessels from the West-Indies and United States, is utterly useless in guarding that country from this pestilence in the form of an epidemic.

It may be said, in answer to these remarks, that the yellow fever and plague are essentially the same disease; the plague has often raged in Great Britain, and therefore the climate may not resist the prevalence of the yellow fever.

But if the plague has raged in Great Britain, which is admitted, it must have arisen from the unhealthy state of the elements, which may exist in any latitude, or from very singular seasons, aided by most powerful local causes, as in London before it was burnt. I say the yellow fever will not spread in England, in the ordinary state of the elements, and the ordinary temperature of the summer. If pestilence ever invades cool northerly countries, it must always proceed principally from disorders in the elements and seasons. The ordinary causes, in temperate or cool climates, have but little influence in generating pestilence. Hence in common seasons, in England, no plague, bilious or inguinal, could be spread, unless in a crowded jail, camp, or dirty, confined alley in a city. If the physicians in England observe the

general state of health to be good ; no epidemics, with unusual symptoms, prevailing ; no uncommon numbers of insects ; or diseases among cattle, or other symptoms of a morbid state of the elements, it is no more in the power of man to render the plague epidemic in that country, than it is the pleurisy or quinsy. I challenge all the faculty in Europe, to mention an instance, in which plague has ever prevailed, without such phenomena.

Besides, it seems to be probable, that more heat is necessary to generate and to propagate the bilious, than the glandular plague. My reasons for this opinion, are, that the glandular plague appears in spring much earlier than the bilious. It often appears in the northern parts of Europe, as early as March and often in May, when the weather is yet cool. But the bilious plague of our climate has not showed itself, in sporadic cases, till June, and then very rarely, and only in a few scattered cases of a less malignant type, than at a later season. To this remark, I have heard of only one exception. Generally, the disease does not appear till we have experienced some days of our hottest weather, and not till the last week in July, except in a few cases as before mentioned. It does not become formidable, as an epidemic, till the tenth or twentieth of August.

This difference seems to depend on the following circumstances. The glandular plague of Europe, Asia and Africa, when it breaks out in the northern latitudes, as on the Baltic or in Great Britain, seems to be more essentially and principally the product of a defective state of the elements, joined to human exhalations in large cities ; both which causes are less dependent on heat, than the morbid exhalations of the vegetable world, which seem to give to our American plague its peculiar character, and to be a powerful cause of the distemper. I am further confirmed in this opinion, by this circumstance. A distinction between the bilious fevers of our *cities*, and of our *marshy grounds* on rivers, is observed to exist, in perfect analogy with the foregoing distinction between our bilious plague and the glandular plague. The mortal fevers, about marshes in the interior of our country, are less infectious, than the pestilential fevers of

our cities, altho they are at times as fatal, and are characterized by a yellow skin. These seem then to proceed *wholly* from vegetable exhalations. The fevers of our cities approach nearer to the plague of the east; because they proceed both from *animal* and *vegetable* exhalations, but the vegetable effluvia have a more predominating influence here, than in countries which are dry or better cultivated. Hence the mortal bilious fevers of our interior country evidently form a link in the series of gradation, between the common remittents, and the yellow fever of our cities; just as the yellow fever constitutes a grade between our river or lake fevers, and the Levant plague.

The order of bilious fevers then stands thus in connection with their causes:—

*In healthy periods.*

Common intermittents, } solely from marsh effluvia, and ordinary remittents— } nary causes.

*In pestilential periods,* under the operation of elemental causes.

Intermittents, } of a worse type, from marsh effluvia, aided by remittents— } a general cause.

Bilious plague of the country, } solely from marsh exhalations, near lakes and rivers— } with the general cause.

Bilious plague of A- } from the joint operation of vegetable, and American cities— } animal effluvia, with the elemental cause.

Inguinal plague } principally from animal exhalations, with the of the east— } elemental cause.

In this gradation of diseases, there is a regular progression of symptoms. Intermittents and remittents exhibit a yellow skin, more or less, but no infection worth naming—the river or lake plague, a very yellow skin, with morbid symptoms, but little infection—the bilious plague of cities, sometimes a yellow skin, sometimes not; and some cases of glandular tumors, carbuncle and petechiæ; with more infection—the Levant plague, less yellowness of the skin, and usually infection and glandular swellings. Thus, in proportion as the vegetable exhalations predom-

inate, in the scale of exciting causes, there is more yellowness of the skin, less infection, and less frequent affections of the glands—in proportion, as the animal exhalations abound, as the cause, the yellowness declines, and the affections of the glands multiply, with augmented infection.

It is the remark of the celebrated Zimmerman, that “exhalations from marshes do not seem to be so noxious in cold, as in hot countries; yet malignant fevers occur even in Finland. In Germany these exhalations produce tertians; in Hungary, petechial fevers; in Italy, hemitritæa; in Egypt and Ethiopia, pestilential fevers.” On Physic, p. 131.

It is therefore probable that a greater degree of heat, than the ordinary temperature of Great Britain, is necessary to generate the pestilential fever of our cities. And as no degree of infection ever yet accumulated on board of a merchantman, can create a pestilential atmosphere, sufficient to generate an epidemic, the fears of the English respecting such vessels from the United States or the West-Indies, are utterly groundless. The marsh fevers of England, Scotland and of other cool climates, are of an inferior grade. Such are the autumnal fevers near the Fenn’s of Lincoln, Ely and Cambridge. In Torbat, in Scotland, a putrid fever sometimes prevails, and after death, the body turns yellow; this may be ascribed to certain natural locks or ponds which sometimes dry up in summer.

Sinclair’s Scot. vol. 6. 418, 428.

But these diseases, tho doubtless the same in species, fall greatly short of the violence of our pestilential yellow fever, which never did and probably never will prevail in that climate.



## SECTION XVII.

*Of the means of preventing or mitigating pestilential diseases.*

**T**HE first step towards an effectual remedy for an evil, is to ascertain its nature and cause, so far as they can be understood by effects. Primary causes are above the reach of man; proximate causes, may be so far investigated, in most things, as to answer all the purposes of mankind.

It has been proved, in the preceding pages, and every day's observation confirms the fact, that one influential cause of epidemic diseases, must exist in the elements, independent of all human control. In the production of epidemic catarrh or influenza, for instance, no human or artificial means appear to have any share of influence. In the measles, artificial causes sometimes modify the symptoms, but have no great share in its production or propagation. A similar remark will apply to every species of angina. The small-pox is also modified in its force and symptoms by many local circumstances; and its propagation is chiefly by means of contagion; but this disease also is sometimes, tho rarely, generated in particular bodies without contagion. The appearance of those diseases in the form of epidemics, excepting the small-pox which may arise from contagion, always indicates a pestilential constitution of air; and during this constitution, ordinary or annual diseases, which depend on season or local causes, assume more violent symptoms.

Autumnal diseases of the annual or ordinary kind, tho rendered more violent, fatal and extensive, by a pestilential state of air, are however generated by subordinate causes, most of which are within the power of man. The dysentery depends partly on season, partly on situation, as to pure air, and partly perhaps on the imperfection of autumnal fruits. Sometimes it arises in

camps from bad diet, or want of shelter from the weather; and when it once exists, is more or less propagated by infection. But this disease is rendered more malignant, by elemental causes.

Ordinary bilious fevers of all grades are produced usually by miasmata or morbid exhalations from low, damp, marshy grounds; where vegetables, in the hot season, are in a state of rapid putrefaction. These fevers occur annually, and with a violence of symptoms proportioned to the extent and force of the morbid cause. The origin and phenomena of all this description of diseases are so well known, as to render any observations of mine, unnecessary.

The plague, glandular and bilious, seems to be nearly allied in its symptoms, to the ordinary bilious remittent. The point seems not altogether settled, whether the contagious yellow fever, as it is usually called, and the common sporadic yellow fever of the West-Indies, and the bilious remittent, are different grades of one species of disease; or whether they are of distinct species.

On this point however, the late epidemics have furnished our scientific men with proofs that appear to me to decide the question, in favor of the identity of the species. The evidence arising from the disease in Baltimore is alone sufficient to decide it, as far as it regards the yellow fever and the remitting; and the Academy of Medicine in Philadelphia is a most respectable authority in favor of the same doctrine.

That the glandular plague of the Levant, and the bilious, infectious yellow fever of our country, are specifically the same disease, I have no doubt; but they take some different symptoms, either from climate, or other causes unknown. The glandular tumors are held, by most writers on the plague, to be the characteristics of the disease, which alone decide its nature, and distinguish it from other malignant fevers. But Diemerbroeck and all the best authors agree that these external swellings are not essential to the disease, and that many have the true plague without them. They are however the usual marks of the disease.

In our bilious pestilence, these swellings are less common. But, tho rare, they sometimes appear, in the most unequivocal

form of the true pestis. I saw an instance in 1796; and they were more common in the last epidemic. An instance occurred, within my knowledge, in which two auxiliary tumors appeared, and the person was never confined by fever.

The yellowness of the skin has given name to the pestilence of our country; yet this is a misfortune, for it may deceive a common observer. A yellow skin often accompanies lower grades of bilious fevers, not pestilential; and is, by no means, essential to the infectious yellow fever. In all our late epidemics, persons have died without exhibiting this color of the skin; and it has been less common the last year, than in former years. It appears then, that the lighter the epidemic disease, the more common the yellowness of the skin; and vice versa. This is no inconsiderable proof of the identity of the bilious and inguinal plague; that in proportion as the bilious plague of our climate becomes violent and approaches the true plague, it loses that yellow color of the skin, and assumes the glandular swellings. This I am informed is the fact, as observed by the physicians in New-York, the summer past. There are however some differences in the symptoms of the two species of plague, which it belongs to the faculty to observe and define. It may be that the moisture of our country, not yet cleared of its woods, and abounding with swamps and marshes, may occasion the differences in the symptoms. The parts of Europe, Asia and Africa where the plague most usually prevails, are clear of woods, and cultivated. Perhaps an increase of population, and human effluvia, with a decrease of vegetable exhalations in America from cultivation, may in time change the form of our pestilential fever into the true inguinal plague. I have reasons for believing such a change actually took place in Rome. Some of the plagues, described by Livy were obviously of the bilious kind, similar to our epidemic fever; but in later periods, the plagues in Rome are expressly described to be, "pestis inguinaria."

However this may be, the causes of pestilence I suppose to be, first some essential alteration in the primary qualities of air and water, owing to seasons, or to the action of the principle of fire, the main operative agent in the earth and atmosphere; which al-

teration is demonstrated by various epidemics and especially by catarrh—secondly, the subordinate causes of plague, are, noxious exhalations of every kind, which diminish the proportion of vital air imbibed into the lungs. Both causes appear to produce disease, either by excessive excitement, inducing *indirect* debility; or by reducing excitement, and inducing *direct* debility. The ærial or elemental cause seems to produce excessive excitement; for its first effect appears in catarrh, a disease of stenic or inflammatory diathesis. Thus the present epidemic constitution was preceded by influenza, of universal prevalence and of severe symptoms.

Measles, another disease that rarely fails to characterize the early stages of a pestilential constitution, is also of an inflammatory diathesis. The same is true of the common distinct small-pox—another disease, which, before the art of inoculation, seldom failed to rage in cities, during such a constitution.

Anginas are of different types; some of the milder kinds are ranged by Brown among stenic diseases; but the angina maligna he considers as astenic. Diseases of this class however form a part of the effects of a pestilential constitution.

Next to this species of diseases, may be arranged the petechial fevers, which under the names of purple, or spotted, have often overspread Europe, and rarely fail to precede the plague. These are the product of the last stages of a pestilential constitution, next to the true plague, which marks the crisis. These forms of malignant fever have never occurred in America, as epidemics; but purple and livid spots, vibices and all the variety of eruptions, which belong to that class of diseases, occur occasionally during pestilence.

It is a remarkable fact, and one that seems to have escaped observation, that a pestilential constitution of air in all ages and countries, produces epidemic disorders of the *eruptive* kind. I question whether in a single instance, since the days of Moses, the real plague, ever became epidemic, without one, two or all of that kind of diseases for its precursors. We cannot look into an author, who has described the diseases which prevail in such



a constitution, from Hippocrates down to our time, but we see ignes sacri, variolæ, morbilli or other *eruptive* disorders, constituting a part of the description. These diseases seem evidently to be classed by the laws of nature, and always to appear, in close connection.

Hence the propriety of Sydenham's observation, p. 120 that "the erysipelas, ignis faciei, is a good deal like the plague, and sometimes accompanied with pains in the glands—that it begins much in the same manner as the plague, but the plague is much more violent than an erysipelas."

Hence also we observe that Hippocrates, in describing a pestilential constitution, mentions that before spring appeared "*erisipelata polla*," many cases of the erysipelas, of a bad type, and mortal.

De morb. Vulgar. Sec. 2.

This is a curious phenomenon and worthy of investigation, that a particular constitution of the atmosphere, should, in its different stages or in different seasons of the year, tend to generate all those diseases, which throw out upon the surface of the body, petechiæ, vibices, a general efflorescence and tumors, with various other appearances. It belongs to medical men to explain the general proximate cause, which, while its effects are various, still gives to diseases some common similitude.

In America, a pestilential constitution exhibits the same phenomena, as measles, and anginas, but without the purple or spotted fever, as the precursor of our pestilence. The immediate precursors of the bilious plague in America, are catarrhus affections, disorders of the throat, and especially bilious fevers of a bad type, ending often in black vomit. Detached cases of this latter disease rarely or never fail to introduce or precede the infectious epidemic.

But no disease whatever seems more closely connected with pestilence than catarrh. An epidemic influenza, is almost invariably the signal of the approach of a pestilential constitution; and during the whole existence of the constitution, catarrhus affections are frequent in particular seasons, and especially just before or after the prevalence of a pestilential fever. This circumstance affords no inconsiderable evidence, that what we call

an epidemic constitution acts upon the human body as a violent stimulus. The first diseases excited by it are usually of the inflammatory diathesis as catarrh and measles. Hence perhaps we derive a clue to explain the mystery of the pestilential diseases which succeed.

The continued effect of excessive stimulus, must be debility. The epidemic constitution, when it first commences, is mild, and produces stenic diseases, not very mortal, as catarrh and measles; for a very obvious reason, the force of the stimulus is not at first sufficient to hasten on the indirect debility of the system, or to produce the astenic diathesis in a fatal degree. But as this state of air advances in strength, the stimulus is greater; and when aided by the heat of summer, produces a degree of excitement, that speedily induces universal debility. Hence the pestilential fevers of summer and autumn seem to be the effect of excessive stimulus, acting upon the system with such violence, as to produce speedy debility, in consequence of which, all the functions of the system are weakened and deranged—the stomach does not digest food—the peristaltic motion is imperfect and feeble—the liver and the gall-bladder do not perform their secretions—the energy of the brain is diminished—the extreme vessels are relaxed. The consequence is, that part of aliment which ought to be separated and carried off by the intestines, as the hepatic fluid, is retained, and forced out of its proper ducts, into other parts of the system, where it excites external eruptions, efflorescence, or yellowness; in every part of the body, becoming rank poison, and speedily inducing fever, morbid affections, and dissolution.

This process is infinitely modified by subordinate causes; as seasons, which are extremely various; local exhalations and stagnant air, which are deleterious according to their force; the various modes of living, which strengthen or weaken the human body; and accidental circumstances, as fatigue, grief, fear, exposure to excessive heat, or sudden cold; and innumerable similar causes.

This idea of the proximate cause of the bilious plague of our climate was imbibed from observation and conversation with physicians, before I had read Brown's Elements of Medicine. I am happy enough to find, on reading that work, a confirmation of

the opinion. That author observes, paragraph 137. "Sometimes the secretory vessels seemed crammed with a colluvies of fluids, capable of producing indirect debility, as in that overflowing of bile, which distinguishes the yellow fever of the torrid zone."

This "colluvies of fluids," lodged in the secretory vessels, seems to act like poison, in disorganizing the system. And the reason why the plague is so often incurable, seems to be the rapidity and the imperceptibility of the action of that poison, which appears totally to undermine the vital powers, before it exhibits much pain or fever. This is not its common mode of operation; but it is not unfrequent. Cases of this kind are soon characterized by a total prostration of strength, a cadaverous look, and a dull, glassy, languid eye, so often described by medical writers. In such cases, debilitating remedies precipitate death; and stimulants are ineffectual to revive the languid functions.

In most cases however the approaches of the disease are accompanied with pains, uneasiness, and febrile symptoms, while the system yet retains its stenic diathesis; in some such cases, debilitating remedies are useful; but the rapidity of the progress of the poison soon changes the diathesis to astenic.

Boyle remarks vol. 1. 672, "that a day or two before the plague has manifested itself, in some persons, their vision has been affected; objects appearing diversified with beautiful colors. A vomit administered to such, usually gave relief." Every observation of such eminent men deserves consideration; but I do not remember to have found the same in any other author. If just, is it not an evidence that the state of air, inducing the disease, operates *first as a stimulus*?

Procopius has recorded of the plague of 543, a phenomenon somewhat similar to that noticed by Boyle. He says, persons imagined they saw phantoms or ghosts, which made them suppose they were smitten by some person. Such as had this imagination, soon perished with the plague.

In 746 also persons were troubled with phantastical images, which filled them with terror. See also the plague in Carthage before Christ 404.

General appearances favor the idea, that what is usually called an epidemic state of air, produces, in the human system, unusual excitement by excessive stimulus. But then how shall we account for the angina maligna, a disease of extreme asthenic diathesis, which often forms one of the series of epidemics, belonging to the same constitution? Is this also the effect of excessive excitement, inducing great debility? Is not its prevalence principally among children of sound health, a proof that it is the consequence of indirect debility?

However these questions may be decided, certain it is that under the same constitution, and during the same pestilence, the fatal diseases assume very different symptoms, and exhibit, in different bodies, a different diathesis. In all epidemics of this sort, a principal object of the physician is to ascertain the general diathesis produced by the constitution of air, and the various effects of it in different bodies. "Hic labor, hoc opus est."\*

The secondary or auxiliary causes of plague, coming under the denomination of *impure air*, are supposed to act upon the system, by directly debilitating powers. "It cannot be doubted, says Brown, 145, that the application of air, to the whole surface of the body is a necessary stimulus. The air is seldom applied in a pure state; it is commonly blended with *foreign matters*, that diminish its stimulating power, and tho its salutary stimulus depends upon its purity, it is uncertain whether ever its purity goes so far as to stimulate in excess and thereby produce sthenic diathesis." I know not what this author would call "purity of air," but I am very certain that an epidemic influenza proceeds from some qualities in the atmosphere, and this author agrees the disease to be of sthenic diathesis. If the disease is the effect of "foreign matter," infused into the air, then this foreign matter is of a stimulating quality.

\* Is not the doctrine of indirect and direct debility, as the source of all diseases fully implied in the first paragraph of Aristotle's first problem? It may be thus rendered. "Why have great excesses a tendency to produce disease, but because they occasion too much or too little excitement, in which all diseases consist." If this is not the precise idea of the author; his doctrine leads to the same results, as those which form the ingenious brunonian system. Many things appear to us new, which are 2000 years old; and solely because we neglect ancient authors.



I suspect however that the atmosphere should be considered as composed of two principal substances, *air* and *fire*, or *electricity*. Morbid matter floats in the *air*, but the principal stimulating power probably consists in the *electricity* of the atmosphere.

The influence of morbid exhalations from putrefying substances, is, probably to diminish the stimulant power of the atmosphere, inducing direct debility. The lungs receive, at every breath, a certain quantity of air; that is, about the same cubic quantity. A certain portion of this, is vital air, oxygen, which serves as food for the lungs and blood, and which is separated from the rest and absorbed. Whenever therefore common air is impregnated with an undue proportion of hydrogen, or with any species of acid, which is hostile to the lungs, these viscera want their proportion of food, or stimulus; the consequence is, their action is weakened, and the heart and arteries want their due force; the effect of which is a more feeble circulation of blood. Perhaps also the septic acid, conveyed to the blood with common air, at every inspiration, gradually destroys its texture.

Sorbaix mentions that a lighted candle being placed near persons dying with the plague, a livid vapor has been seen, issuing from their mouths. Extremely vitiated must be the air from the lungs, before it can be rendered inflammable.

But whatever may be the process, we know the effects of respiration in air vitiated by morbid exhalations, to be fevers of various kinds, as intermitting, remitting, dysenteric, and putrid or pestilential. That state of the atmosphere which I call *pestilential*, has a singular effect in increasing the irritability of the nervous system, by which means slighter causes than usual occasion dangerous inflammation.

Having then arrived at the probable causes of the pestilential fevers which afflict the earth, we are prepared to consider the means of prevention.

The first article under this head, is, the removal of all local causes of disease; such as every species of putrescible substances, which, in the process of putrefaction, emit a species of air highly unfriendly to health. It will be observed that I speak of

*putrescible* substances ; for flesh or vegetables, which have undergone the process of putrefaction, or of digestion in a healthy stomach, discharge little or none of the pernicious acid.

Hence we observe that people in cities rely too much on cleansing streets to preserve public health. Experience proves that the utmost care in cleansing streets will not always prevent pestilence. The reason is obvious ; most of the filth of streets consists of excrementitious matter from horses or oxen, which has undergone the process mentioned, and contains no septic acid, or very little. Hence the accumulation of dung in the farmer's yard, is not known to generate diseases.

Various other substances, thrown into the streets of cities, are more pernicious ; as green vegetables, the garbage of fish, lees of fermenting liquors, and many others, which, in hot weather, soon putrefy and discharge noxious air. Such substances however never ought to be thrown into the street in hot weather ; they should be thrown into the ocean, into rivers of running water, or what is better still, *buried*, and that before putrefaction begins. If putrefaction is begun, they should be removed in covered vessels.

The vaults of cloacina, altho they contain mostly substances, which have passed through digestion, and in their unmixed state, are not *very* pernicious, yet they are always mixed with other substances, which, in hot weather, bring on fermentation. These should be either cleansed annually in spring, or the matter in them neutralized by quick-lime.

All filthy substances should be removed from streets, both for the sake of decency and of health. If the pavements of streets could be covered with pure earth, it would greatly lessen the heat ; but this is not practicable. The only effectual remedy, is fresh running water—the only article that unites cleanliness with coolness. Nothing, in a city, can be an adequate substitute ; for while it removes the causes of noxious vapors, and by cooling the sultry air of a city, prevents debility, it extricates a considerable quantity of new and wholesome air, from its own substance, and absorbs pernicious vapors.

Streets should also be so constructed as to give the water a con-

siderable velocity. The practice of levelling the surface of a city, is most pernicious. If possible, every street in a city should have a descent of fifteen or twenty degrees. Instead of levelling the earth, the police of a city should counteract even a natural level, by throwing the whole into artificial elevations; which give a brisker currency both to water and air.

Cellars should be so constructed, as to retain no water; and often cleansed by scraping. If the surface of the cellar can be conveniently changed, by removing a few inches of the old earth and introducing that which is fresh, it would be a very salutary labor. Nothing imbibes and neutralizes infectious matter, more readily than fresh earth.

The liberal use of water, in and about a house, cannot be too seriously recommended. Water absorbs all noxious matter that comes in contact with it in substance. Applied to floors, wooden, stone or brick walls, to clothes, to furniture, to back-yards and streets; it is every where salutary in the summer months. Dr. Priestly observes, that water purifies vitiated air, by absorbing the septic part. Hence its great utility as a preservative against pestilential diseases.

All dead animals in a city or its vicinity, should be buried or burnt; as cats, dogs and horses. The indecency alone of suffering their carcases to putrefy before the eyes of mankind, ought to make it a strict article of police, to remove them. But they should be buried; not one should be permitted to offend the eyes or nostrils of a citizen.\* They are offensive to decency, to moral sentiments and to health. The ancient method of burning dead bodies was well calculated to destroy the poison; but in Atlantic America, burial is cheaper and equally effectual.

Common sewers are often common nuisances. In cities, all filthy substances should be conveyed off, on the visible surface of the earth, unless sewers can be so constructed as to deposit, with certainty, all their contents in running water. Serious evils arise from putrid substances lodged in sewers, that are too level, and

\* From two years observations, made as I passed daily from New-York to my residence in the country, I judge from twenty to thirty worn-out cart-horses die and putrefy in the suburbs of that city, every year.

which serve as reservoirs instead of canals, accumulating putrescible matters, in places where their exhalations, by the influence of moisture, are doubled, instead of being removed.

In cities, where all filth is naturally cast by rains into the docks, it would be well that all wharves should be so constructed, as to present a smooth uniform front to the stream, and be extended into deep water. Mud, washed by the salt tides, and not mixed with putrescible matters, produces no inconvenience to health; but such matters, thrown into docks, bare at low water, and exposed to a hot sun, dissolve most rapidly, and generate morbid vapors. Many improvements are yet to be made in our sea-ports, which will lessen the accumulation of pernicious air.

A great and most desirable article in a system for the preservation of health, is, the purifying of rooms from air which has been respired for a length of time. By experiment it is found that the air of rooms that have been slept in, is very insalubrious; and probably more so, than the air of privies, which is found to contain less noxious air than was formerly supposed. See *Encyclopedia*, art. *Atmosphere*. Indeed, it is questionable whether there is any *necessary* connection between offensive smells and insalubrity. Nature has kindly provided that dead feces should not be very pernicious to health; but the effluvia of living and fermenting bodies are to be avoided as rank poison. In this respect cleanliness is made essential to health.

It is impossible in a work of this kind to enter upon the details of cleansing a great commercial city. The magistrates, aided by medical men, in every city, will attend to the minute regulations for preserving a pure air.

But there are other causes of autumnal diseases, which must not be overlooked.

It is remarked by writers that the diseases from marshes and stagnant waters are most violent near their sources; and gradually abate in their violence and become less common, as they recede from those sources. See Buel on the marsh fevers at Sheffield. *Medical Repos.* vol. 1. 457. Hence, in a country generally mountainous or hilly, dry and salubrious, but containing



here and there a pond of dead water or marsh, the bilious fevers generated by the effluvia, will be local, rarely extending beyond one mile and a half from their source.

But there are some extensive marshes, which may produce effects to a much greater distance. Such are the low grounds in Hungary, a sickly region; the pontine marshes near Naples, which may affect the health of people in Rome; the flat lands and rice plantations in Bengal on the Ganges—the coast of Terra Firma in South-America, and the marshes from E. Florida to the Delaware in North America. The fevers of Cambridge, Ely and Lincolnshire in England, may be classed with those above mentioned; but are of smaller extent.

It is an opinion in Constantinople that the frequency of the plague in that city, is to be attributed to the northerly winds, which come from the marshes of Tartary and Russia, bordering on the Euxine, sweeping that sea, and conveying moisture and noxious exhalations.

The position of that city is otherwise a very healthy one—the climate is temperate—the site of the city, high, dry and rising into hills and mountains on the west. No cause of unusual diseases can be found in the neighborhood. The causes within the city, are powerful. Many of the streets are narrow, filthy, crowded, and almost obstructed by pent-houses. But in this respect, Constantinople is not worse than one half the cities of Europe. Shall we then admit that winds will convey morbid exhalations, several hundred miles, without dissipating them, so as to render them innocuous? Let us attend to other facts.

No city in Europe, except Constantinople, has been more frequently desolated by plagues, than Rome, from the time of Romulus to the close of the last century. Shall we ascribe this, to the vast marshes which border the shore from the mouths of the Tiber to Naples? Certain it is, that Rome has ever been considered, as a very unhealthy city; and the terrible plagues which ravaged it, when in the utmost prosperity, as well as in modern times, justify this opinion. So sensible have the inhabitants been of the prevalence of this opinion abroad, and the ill-effects of it in preventing strangers from resorting to the city, that Lancisius,

an eminent physician of the present century, wrote a considerable treatise, evidently with a view to remove this opinion.

This author observes, that south winds at Rome, if violent, humid, with clouds and heat, produce inconvenience, and if they pass over marsh, they may bring "particulas lethiferas," very pernicious vapors, which produce pestilential diseases.

The Romans very early took measures to correct the evils to which the city was exposed. The enormous cloacæ, or sewers were raised at a vast expense, to carry off all stagnant water, and dry the soil, and while kept clean, were very useful. Hence cloacina was deified as the goddess of health. These sewers were under the care of certain officers, called "Curatores Cloacarum Urbis." In one instance, these drains had been a long time neglected, and were cleansed at the expense of a thousand talents. Severe laws were enacted, prohibiting individuals, under penalty of a fine, to suffer water to stagnate.

Lancisus ascribes the severe diseases which afflicted Rome, in the decline of the Empire, to the destruction of the aqueducts and neglect of the sewers. In 1695, when the ditch of Adrian's tower, and the great sewer of the city Leonina, were filled with filth, immediately on the blowing of the south wind, began pestilential diseases. By order of the Pope, at this author's suggestion, the streets, vaults, ditches and all similar places, were thoroughly cleansed, and ten years after, no epidemic malignant disease had appeared. He however observes that when a south wind blows for a long time, acute fevers, tertians, pains in the head, and vertigo become epidemic. This must be occasioned by the debilitating effects of that wind, or by miasmata conveyed from a distance, probably from the pontine marshes.

See Lancisus, passim.

Egypt is a flat country, containing not much marsh, but annually overflowed, and subject to most of the inconveniences of marshy countries, from the drying of its moist surface, in very hot weather. Here again we have a nursery of pestilence.

The banks of the Euphrates and Tigris are nearly in the same predicament, and Bassora, is in Persia, what Cairo, is in Egypt.

Most of the coast of South America, from Carthagena to the Oronoke, is bordered with marsh, and is every where sickly.

But what shall we say to the marsh on our own shore? The low swampy lands that border all the rivers, in the flat country of Maryland, Virginia and the Carolinas, and the immense tract of bog in Virginia called the *dismal*? The effects of them on the neighboring inhabitants are well known—annual and almost universal intermittents, and often, remittents.

Is it not possible and probable, that the noxious exhalations from these vast hot-beds of putrefaction, are borne on the south-westerly winds, which prevail almost constantly in June, July and August, and which run parallel with the general trending of the coast, from Florida to New-York? Do they not impregnate the whole atmosphere for a considerable breadth, and sweep the country, from the eastern shore of the Chesapeek to Philadelphia, New-Jersey, and in a slighter degree, to New-York? I do not give a positive opinion on this subject; but the annual prevalence of slight intermittents on York-Island, and in the city, tho' far removed from any marsh, and continually ventilated by sea breezes, as well as washed by rapid tides, affords some ground to believe this suggestion.

It is confirmatory of this idea, that soon after leaving York-Island towards the east, all intermittents disappear; unless in a very few places, where they proceed from obvious local causes: Now it must be observed, that the coast of the United States, runs generally from south-west to north-east; but at New-York, it takes a different course, and runs about east by north, for two hundred miles. This course soon carries the people on the shore, beyond the reach of the supposed stream of morbid vapor, from the southern marshes, whose course is with the south westerly winds.

I am not attached to this idea; but it is in conformity with the opinion of the insalubrity of the Euxine winds, at Constantinople; and with the effects of the southerly Calabrian wind, blowing over the pontine marshes, towards Rome. Lancelus relates a remarkable fact. Thirty gentlemen and ladies went on a party of pleasure, towards the mouth of the Tiber. The wind shifted suddenly, and blew from the marshes, "*paludes ostienses*," and twenty-nine of them were immediately seized with a tertian. If such was the effect of the vapors from those

marshes, we may suppose the vast pontine marsh would poison the air to a much greater distance.

That the extensive morasses, along our southern shore, are pregnant with mischief to that country is certain; that the people of Philadelphia and New-York are affected by them, may be possible. It would therefore deserve consideration, whether the evil will admit of a remedy. There are two modes of rendering marshy lands and stagnating water salubrious—one, by draining the lands and cultivating them; the other, by turning into them streams of running water. It is probable that most of the marsh at the southward, being within reach of tides, and below high water, is incapable of being drained. It is the pontine region of North-America. How far the second plan can be applied with success, I have not the local knowledge of the land and rivers to determine. The classic reader will recollect the instance, related in history of Empedocles, the Sicilian philosopher and poet, who put an end to pestilential diseases, among the Salinarii, by turning two streams of good water into the marshes, from which they originated.

If there is a possibility of drying any of the lands, now covered with poison, or of putting the dead water into motion, the United States have a vast interest in effecting that object; and expenses are not to be put in competition with the health and lives of our citizens.

The same remark is applicable to all the marshes in other parts of the country, as about some of the lakes; and to all smaller sources of disease, swamps and ponds. In every possible situation, where stagnant water contains vegetable substances in abundance, diseases must prevail. Running water, on the other hand, is salubrious. It not only does not exhale morbid air, but it generates fresh and pure air; at the same time, it creates a gentle breeze by its current, which helps to dissipate any noxious particles in its neighborhood which may arise from other sources.

People in the country cannot be too careful in selecting a spot for their habitation. The question, of continued health or disease, of long life or premature death, hangs very often upon the choice of a salubrious situation for a house.



A farmer should never plant his dwelling by the side of a marsh. Whatever may be the situation of his lands, he is inexcusable, if he builds his mansion within a mile of the sources of disease and death. Better for him to go a mile and a half to his daily labor, enjoying robust health, than to live within the circulation of poisonous vapors, afflicted by diseases for three months in the year. And when a farmer has the misfortune to be obliged to labor occasionally in the vicinity of stagnant water, he should be careful not to enter upon the ground early in the morning, before the noxious vapors have been raised and attenuated by the heat of the sun, nor should he continue there, till late in the evening.

People in the country should select hilly or elevated positions for their houses; where the surface of the earth is dry, and there is a free circulation of pure air. There is another reason—the water on high grounds is always better than in low, swampy places. Water in flat lands stagnates beneath the surface, as well as above; but on hills, it is in constant motion. Hence if men expect good water they must seek for it on mountains, hills and rising grounds. The Arabians advise that houses should be set on high, airy places, near fresh water.

When a choice of difficulties occurs, and men are compelled to live near marsh, they should endeavor to place their dwelling on the windward side of the marsh, which, in America, is the south and west; the summer winds being from these points. This will often make a prodigious difference in the state of health.

The fables of antiquity are mostly obscure and not well understood by the moderns; but some of them are easily explained, and contain most excellent lessons. The story of Python, the huge serpent, which alarmed and infested the world, until he was slain by Apollo, is of this kind. Python was generated by the action of heat on the mud and slime, which covered the earth, after the recess of the water of Ducalion's flood. That is, Python was disease, proceeding from noxious exhalations, in hot seasons, which was destroyed by Apollo, the sun, which dried and purified the earth. See Ovid, *Metam.* lib. 1. This fable had its origin in Egypt, where Python was killed by Isis and Orus.

Of what consequence is it that we read books, if we neither understand nor practise the lessons they contain?

But after attending to every circumstance that can assist in guarding health from the annoyances that are local and visible, we have a further task to perform, to lessen the effects of that elemental principle of disease, which has been proved to exist, in every clime, at certain unequal periods. If, it will be said, such a cause of epidemic diseases, does in fact exist, and operate on every species of life, vegetable and animal, this cause is above human control; all our efforts to avoid its effects, are useless; and we are doomed by the decrees of heaven, to be the victims of pestilence, without hope or remedy.

To this I answer; that if all history is not a forgery, the state of the elements, has, in few instances, been so ill-adapted to support health and life, or so positively pernicious, that men have perished by millions; in the most healthy regions, exposed to no local causes of disease whatever, except such as exist in the most healthy periods. This I must believe; but the fact affords no ground of complaint against providence; for the same fate has attended all other species of animals. The horse, the ox, the sheep, the dog, the cat, the fowls, and the fish, are subject to the same universal law of the physical world; and on what principle will man arraign this disposition of all created life, or claim an exemption from the laws, to which all other species of animals are subjected?

But we are not altogether without hope, even in the desperate circumstances mentioned. If we attend to the causes of plagues, we shall find they all tend to destroy life by *one general effect*, which is, *debility*. Either directly or indirectly, all the exciting causes close their operation on the system, by inducing *debility*, leaving the nerves, muscles, and intestines in a relaxed, languid state.

If this principle is just, and it is agreeable to the medical idea that debility is the cause of all fevers, we have a clue that will lead us to the means of escaping the evils of pestilence.

In the morbid state of air, producing the uncontrollable pestilences, which have assailed man in the healthiest situations on the

globe, we observe that the most terrible effects have been produced, in seasons, when the air has been warm, humid, unelastic, with light southerly breezes; as in the reign of M. Aurelius, of Gallienus, and of Edward III. This state of the air served very much to aid the pestilential principle, in debilitating the human body. All local causes probably tend to the same effect.

The great desideratum then is, how to counteract the debilitating operation of these causes, and *preserve the tone of the system*. I am persuaded that all the means of prevention are comprised in that idea. No man is taken ill with this furious disease, until his nervous system and his intestines cease to perform their usual functions, and secretions are suspended or diminished. Hence persons, as long as their evacuations are regular, may walk with safety in the most infected places, until their eyes and their color exhibit the poison that is imbibed; yet they will not suffer by the disease, while the vessels have strength to discharge the morbid matter by regular secretions and evacuations. This is a known and a common fact.

Hence some persons and even physicians have resorted, during the plague, to small doses of calomel, or other purgative, to keep open bowels. A most pernicious practice to those in health, for it induces the very evil meant to be avoided, *debility*; and ultimately, the intestines becoming unable to perform their functions, disease and death ensue. I am well informed of a number of cases of this kind, in New-York, the last summer, which ended in death.

The *true means* to preserve the natural tone of the body, are the *most natural means*.

First. Food is the natural stimulus of the system. During pestilence therefore this article demands the first notice. It is agreed by all writers, and observation justifies the opinion, that temperance is essential to health, during a sickly season. Some persons, mistaking temperance for abstinence, have run into an extreme of abstinence, which has been fatal to them. The true point to be observed, is, to take as much food and drink, as will sustain the body in its usual degree of strength; without

overcharging it with stimulus. Too much food produces unusual excitement, which is followed by indirect debility, a state of body which invites an attack of pestilence. Too little nourishment, on the other hand, induces direct debility, a state equally favorable to disease. I have good grounds for believing some very valuable citizens of New-York, of my acquaintance, fell sacrifices to their excess of caution in the use of food, during the last epidemic.

It is not improbable that different constitutions of air, as they produce various symptoms in the same diseases, may require or admit of very different degrees of stimulus, applied to the human body. The epidemic in New-York in 1795, like that in Philadelphia in 1793, was characterized with inflammatory diathesis, more frequently than in 1798. Hence venesection, which had acquired great celebrity in 1793, lost part of its credit, in 1798, and was used with more discrimination and caution.

I suspect the same circumstance has changed or modified the opinion of the great utility of abstaining from generous diet and liquors. This opinion was general and well received in 1795; nor have any cases come to my knowledge, in which the practice was supposed to be injurious. But in 1798, many instances occurred where persons of the most slender habits, of strict abstinence from stimulating diet, and who weakened the system by purges, were seized with uncommon violence by the pestilence, and perished. On the contrary, I am acquainted with several physicians, who took their usual quantity of food, with some wine and more than their customary quantity of porter, who attended the sick, thro the season, visiting the most infected places, without suffering the least inconvenience to their health.

If the point is admitted that debility is the great proximate cause of this disease, which I think cannot be contested, the consequence is plain, that whatever tends to reduce the vigor of the system below its usual standard, must be prejudicial, during its prevalence. Hence the propriety of rather increasing than lessening the usual quantity of food, or natural stimulus; carefully avoiding, at the same time, all excess in eating or drinking, which is equally dangerous.



Another thing to be observed, in summer, and especially in time of pestilence, is, the guarding the body, but by all means, the head, from the direct rays of the sun. Nothing is more dangerous than the burning heat of a clear sun, in sultry weather. It often produces sudden death, by means of an apoplexy, instances of which are related under the year 1752, to have happened at Charleston; and the same is said to have taken place there, the summer past. In other cases, the effect is, what is called a stroke of the sun, "coup du soleil," which is not always fatal, but very dangerous.

But the most general ill-effect of exposure to a hot sun, is, great debility, in consequence of the violent and unnatural excitement; and this effect is most to be found in the nervous system, when the heat has fallen directly on the head. Convalescents from bilious fevers have occasion to be particularly cautious, not to expose themselves to a hot sun; a relapse is the most certain consequence.

The umbrella is an excellent invention; it would be still more excellent, if it could be improved, so as to render the shade more general, and completely interrupt the rays of the sun, without being rendered too heavy.

In walking the streets of a city, in a clear hot day, the passenger will naturally seek the shady side. Of so much importance is it thought, in some hot countries, to shield the body from the rays of the sun, that very discerning men contend that narrow streets and high houses, in cities, contribute to the health of the citizens, by mitigating the heat. They suppose the obstruction of air a less evil, than a hot sun. Of this opinion was Lanciscus.

But this is to embrace one evil, in shunning another. It is to be regretted that the best mode of shielding man from a hot sun, is not adopted in cities. Wide streets, bordered with rows of trees, would be infinitely preferable to all the artificial shades that can be invented. Trees are the coolers given to us by nature. They make a pleasant shade—they imbibe the septic fluids, which impregnate the atmosphere of cities, and poison their inhabitants—they exhale pure air—they fan the earth, by creating

or augmenting currents of air, with the vibratory movement of their leaves—they invite the feathered tribe to light on their branches, and with the music of their notes, to relieve the ear from the grating of rough, unnatural sounds, which stun the citizen.

It has been objected to trees, that they increase the danger of fire, by obstructing the free use of engines. This objection is imaginary. Few cases would occur, where trees, properly placed, could interfere with the operations of extinguishing fire; and in such cases, they might be levelled in a moment.

It has also been objected, that trees obstruct the free circulation of air. This is not true. In calm summer weather, they very much increase a light breeze, by partly obstructing the upper current with their branches, and throwing more air below, thus augmenting the under current on the surface of the earth, where it is wanted. The leaves and branches also, by their gentle motion, agitate the air, preventing the ill effects of stagnation; and give velocity to the air that finds its way through their interstices.

"The streets and public squares of a city, says St. Pierre, should be planted with great trees of various sorts. A city, built of marble, would to me have a melancholy appearance, unless I could see in it trees and verdure."

*Studies of Nature, 13.*

Trees and all green vegetables diminish greatly the heat near the earth; and little do men in general think, how prejudicial to health is the operation of the extreme heat of cities.

It is not an uncommon thing in the country, where no miasmata exist, for laboring men to over heat themselves in the field, and die in six days, with a bilious fever; their bodies as yellow as saffron. This is yellow fever of a mild kind, generated in the system, by the debility occasioned by excessive heat and fatigue, without any external cause. Thus the extreme heat of August and September 1798 will alone account for the unusual violence and extent of the pestilential fever of that year.

In the warm season, and especially in time of epidemic fevers, people should be doubly cautious not to expose their health by excessive fatigue. Labor should not be violent, and walking, moderate. In extreme heat, the natural excitement of the system, is usually too great; and a small addition to it throws the body

into a state of debility which invites disease. Not only health, but life, is often suspended on the point of half an hour's exercise. Temperance in labor, bodily or mental, is as essential to good health, as in eating or drinking. The muscles and the nerves, those moving powers of the human body, if stimulated beyond a certain point, lose their excitability, beyond the possibility of recovery.

The danger incurred by sedentary and studious men, during pestilence, from the debilitating effects of their occupations, is greatly increased. Want of due exercise is directly relaxing to the solids; while application of the mind is apt to over-excite the nerves and induce indirect debility. The extreme irritability of the nervous system, is obvious in a pestilential state of air. —I experienced it most sensibly in the summer of 1795, during the fever in New-York; and it is evidenced in the vertigo, so frequent at such times; in the seizure of many persons in the plague with apoplectic symptoms; and in the palsies and apoplexies which are greatly multiplied before or after the prevalence of a pestilence, and which in some places, have become almost epidemic.

During the rage of epidemic pestilence, also the animal appetite should be indulged with moderation—excessive indulgence, which might have been sustained at other times, has often hurried the young and sprightly, to a premature grave. Nothing can be more dangerous, according to all medical writers on this subject.

Celsus directs that in pestilence, persons should seek fresh air, travel, sail; or if these are not convenient, they should avoid fatigue, indigestion, cold, heat, excessive indulgence of the animal desires; especially says the author, in a pestilence which is occasioned by southerly winds. Vol. i. 40, 41.

These observations are not new; they are common and well known to medical men, and to all others of discernment. They are here inserted, because they may be, in this work, more generally read, than in medical books, which are opened only by professional men.

But all these rules, if strictly observed, will not, in a more violent plague, be sufficient to secure the body from attack. Such are the extremely debilitating qualities of the air, in some periods, that it will be necessary to counteract them by artificial powers positively tonic.

The application for this purpose, which is most easy and effectual, is *water*; an article which nature has furnished in the greatest abundance, because it is far the most useful. On this subject perhaps some of the following ideas may not be very common.

My attention to water, as a preventative of pestilence, was first excited by a passage in Volney's Travels in Egypt and Syria, chap. 17. where he informs us in a note that "at Cairo, it is observed, the water-carriers, continually wet with the fresh water they carry in skins upon their backs, are never subject to the plague."—The author is there speaking of the pernicious effects of humidity on health; but the escape of the water-carriers, he ascribes to *lotion*, whose effects are different from those of moisture by vapor.

If this fact is accurately stated, it is worth an empire. I am inclined to believe it and to ascribe the escape of those men to the constant application of water to their bodies, during the labors of the day. Yet if true, why have not authors propagated the knowledge of so important a truth, to every part of the world? Is this neglect also the fruit of the pernicious errors respecting the exclusive origin of the plague from infection? The calamities sustained by mankind, in consequence of those errors, exceed all calculation.

How is it possible, that, if a remedy for the calamity of pestilence, is so obvious and so near at hand, the Egyptians should not have applied it universally? Can this be ascribed to the doctrine of predestination, which makes them careless of the means of prevention?

It is very certain that the laws of Moses, respecting the prohibition of blood, fat, swine's flesh, and certain other animals; as also the whole system of ablutions, purifications, and use of perfumes, were intended to correct the evils of the climate; and



many of his directions became totally useless, when the Israelites left that country and its vicinity. Heaven never could intend some of the provisions of the Mosaic code, for more temperate and healthy climates.

The ancient Egyptians had similar practices, and probably long before the days of Moses. Their laws and customs to ensure cleanliness were very strict, and they involved a most liberal use of water. Herodotus expressly declares that "they scour their cups, wash their linen, and *circumcise for the sake of cleanliness*. The priests bathe twice by day and twice by night, and are obliged to wear linen." Swine's flesh was also considered to be unclean and prohibited as an article of food.

See Book 2. Euterpe.

These regulations doubtless proceeded from the experience of their good effects. It is not improbable that the introduction of the Mahometan religion, may have been accompanied with the abolition or disuse of ancient practices, which were friendly to health. Certain it is, that the oriental nations make great use of baths; the original design of which was probably to guard against diseases, but which have been abused and converted to the purposes of luxury.

Let us then pursue the idea of applying water as a panoply against the attacks of pestilence. By what means does water guard the body from that disease?

I have already quoted the observation of Dr. Priestley, to prove that water absorbs the septic acid. If this opinion is well founded, and I have no doubt of it, we have obtained a most essential item of knowledge. Fresh water frequently applied to the body receives and carries off all the matter of infection, thus removing *one* copious source of the disease.

Savary remarks, that pestiferous matter, passed through water, will not communicate the distemper. This is a confirmation of Dr. Priestley's principles.

The cessation of the plague in Egypt, on the inundation of the Nile, is no small evidence of the same principle. The water changes the state of the air, both by absorption, that is, imbibing and carrying off the pestiferous sources of vapor from the earth; and by extricating a quantity of fresh air. And this

important fact directs to the mode by which all great cities are to prevent or lessen the force of this disease. What the Nile does once a year for Egypt, fresh streams of water should do every day, in the hot season, for all large towns—they *should inundate the streets*. Nature has given, in Egypt, the most ancient and the most common nursery of the plague, the *model* of the best remedy for the severest calamity incident to man; a model which few cities have been wise enough to copy.

But it will not be sufficient to trust wholly to the effect of a diffusion of water over a city. In the hot season, it should be applied to the body very frequently in the way of lotion or bathing. By this I do not mean to recommend the practice of leaping into river or sea-water, and continuing in it for half an hour—a practice which proves fatal to many lives every summer. Cold water is the most powerfully debilitating application, that can be made to the body. No persons can bear it, even in summer, but the healthy and robust; and to save such from injury, it must not be applied when the body is over-heated, or continued too long. Many—many instances occur every year, in which a fatal yellow fever is speedily induced by injudicious plunging. An instantaneous application of cool water to the body, by a single plunge, or by a shower bath, sometimes acts as a stimulant, by a sudden increase of excitability in the system; but this should be used as a remedy, under the direction of a physician. Few persons can sustain the shock, unless in good health; and I am persuaded it would be as well for mankind, if the use of cold water by plunging, were wholly proscribed. Judiciously applied, it is sometimes useful; but my own observations lead me to believe, the utility is more than overbalanced by its fatal or mischievous effects.

The most safe, easy, pleasant and beneficial mode of using water, is, to bathe or wash the body in a private apartment at home. This may be done in several ways—either in a large vessel immersing the whole body at once; or, what is less troublesome, with a single pail or bowl of water, in a bed chamber. The washing may be done with the hand, or a sponge, in a few minutes, as the person rises in the morning or retires, at night.

The temperature of the water should be near that of the blood ; a little cooler or a little warmer, and in such a temperature, it is a pleasant application, occasioning no violence to the system.

It may not be obvious to every common reader, that the application of warm water to the surface of the body, in a hot day, should cool it. But such is the fact, and nature points out this mode of reducing the heat of the body, by the process of perspiration. In this process, the insensible vapor, which escapes by the perspiratory ducts, takes with it a portion of heat—and the more freely a person perspires, the more temperate, the heat of his body. Hence the human body is enabled to sustain heat, several degrees above that of the blood—and hence the flesh of a child, in full health perspiring freely, feels cooler than the air, in a summer's day. This phenomenon may be illustrated by a thermometer, with the utmost ease. Immerse the bulb into warm water, in a hot day. Let the water be of 75 degrees of heat and the air, of 80 degrees. The thermometer, standing at 75 deg. in the water, and taken out into a warmer medium, the air, ought to rise to 80 deg. but being wet, the evaporation will sink the mercury four or five degrees ; that is to about 70 deg. until the instrument is dry, when it will rise to 80 deg. the temperature of the air.

On this principle warm water, as well as cool, will lessen the heat of the system ; for no sooner does a person cease to apply the water, than evaporation commences and cools the body by several degrees. This effect however is temporary, in consequence of the stimulus of the heat.

In very hot weather it is better, especially for *persons in the vigor of health*, to use water a little cooler, than the blood ; for the effect of warm water, applied in the manner proposed, is to stimulate—and this is not what the body requires. On the contrary, when highly excited by the heat of the air, the body requires a reduction of heat, to prevent over-excitement, and its effect, indirect debility. In general then the body in summer is to be cooled by the use of water, while in a healthy state ; but if debility or disease has invaded it, it requires heat and excitement.

Persons of a *slender habit*, who require additional stimulus, should use water a little warmer than the blood. The effect of cool water applied to persons in full health, and of warm water, to feeble habits, is the same; to *prevent debility*; *indirect* in the former case, and *direct*, in the latter.

Bathing a long time in very warm water, to produce profuse perspiration, is a powerful laxative; and perhaps it would be better, if it was never used, except as a remedy for disease, under the direction of physicians.

The beneficial effects of the use of water, in pestilence, therefore, are these.—The poisonous particles composing infection, and exhalations of all kinds, are washed from the body, and their ill effects prevented—the morbid matter exhaled from the body by the perspiratory vessels, is also removed—an effect that may be aided by frequent changes of clean linen.—The extreme vessels are stimulated and cleansed, by which means they are enabled to carry on more perfectly the excretions; perspiration being one of the principal resources of nature to expel the poison which enkindles the flame of pestilence.—The whole system is kept in equilibrio, by a diminution of excitement, in the robust, and an increase of it, in the debilitated; the consequence is, the system is daily renewing its tone and vigor, the energy of the brain is preserved, the muscular fibres retain their powers, and all the functions of the body, the digestion, circulation, secretions, and evacuations, are regularly performed.

Medical gentlemen will excuse me for these ideas, which belong more properly to their province. They are not new to that description of citizens; but, if just, they ought to be universally known; for they lay the best foundation for a regular plan of economy, in domestic life, which will greatly alleviate the distresses of autumnal epidemics. I cannot help thinking that mankind are yet in their infancy, in this respect; and that in general they understand the true art of living, which shall secure health and happiness, as little as they understood agriculture or naval architecture, in the days of Henry the first.

I am persuaded that the whole art of securing ourselves from  
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pestilence, as I have before remarked, consists in this simple maxim—"preserve the natural energy of the system." That watery, fresh and pure, is the instrument most efficacious for this purpose, I must believe, from reason and experiment. The fact related by Volney of the escape of the water-carriers, is of infinite weight, if fairly stated; and demands immediate application to our own case. At any rate, it demands investigation.

I have other proof of the success of water, used as I have prescribed. A friend of mine, who has lived many years in the West-Indies, who has seen the yellow fever in all its forms, who has tended the sick in that climate and in New-York, exposed himself to their breath and effluvia for days and nights successively and slept with his own son, when on his death-bed, with that disease, has hitherto escaped the infection. He ascribes this impunity to a daily use of water in the manner abovementioned.

We are not to calculate on the universal and invariable success of any remedy for this terrible calamity. Multitudes of men will not take the pains to use the means necessary to resist the effects of the numerous causes of disease which surround them. They will neither regulate their diet, nor cleanse their persons and habitations; and when to the influence of their own intemperance, and the poison generated in their houses and on their bodies, is added the debilitating operation of peculiar seasons and other causes which are above human control, great numbers of them must sink and perish.

Nor is it to be supposed that any human means can, in every case, guard life, in a pestilential state of air. If we admit *debility* to be the universal proximate cause of the plague, we are not sure that our best efforts to obviate its effects will always succeed. We may not be able to find or to apply, in all cases and under all circumstances, the precise degree of stimulus, necessary to preserve the corporeal functions; and the variety of constitutions, and diverse operations of the same remedies on different bodies, will defeat, in some cases, the most exact application of the best possible system.

Of one thing I am confident, that, in our cities as now constructed, no rigors of police can so effectually cleanse away the

sources of poison, as to prevent a return of pestilence, without the universal introduction of a new domestic economy, and new modes of living. I am firmly persuaded that fruitful sources of the evil lie in these two articles—the excessive use of stimulant food and liquors, and the neglect of personal washing. The diet of the Americans, like that of the English, is of the most nourishing kind—a large portion of the best flesh meats, and high-seasoned fish and vegetables. Our drink is of the same character—the best high wines, spirits and brandy.

In winter, our bodies sustain this stimulant mode of living; the extreme cold continually resisting its effects by its debilitating powers. But when summer arrives, and the violent stimulus of heat, is added to the high stimulus of the best diet, two classes of men fall a sacrifice to violent fevers. First, men who push their stimulus beyond the powers of nature, by excessive exertion, and intemperance in eating and drinking—hence a robust man riots in debauch to day, and four days after is in his grave. Secondly, men who live freely in winter, and reduce their diet too low in summer, to avoid diseases, inducing a weak, languid state of the system.

It must be obvious to any person in America, that the French mode of living, in regard to diet, drink, and the liberal use of water, protects them from the epidemic diseases which prey upon the Americans, and British natives. Nor have I the least doubt, that a suitable regimen, pursued rigorously by the Europeans, would have saved one half the people, who perished in the black pestilence in 1348.

Unfortunate souls! They believed the plague to be communicated by infection only; they sought safety by flight; they embarked on board of vessels, and launched out upon the ocean, to escape infection; but all in vain; the disease attacked them in every situation, and the world was almost dispeopled. Had they known that the distemper was induced solely by the debilitating qualities of the elements and the season, what multitudes would have applied the true remedy, and survived! Thanks to a kind providence, such a singularly depressing state of the air, rarely occurs, but when it does, there is no flight from the sources of dis-

ease, as in ordinary plagues, which arise in the impure atmosphere of cities only; but men must have recourse to the applications which resist the effects of debility, and maintain the energy of the system by supplying the defective powers of the elements, with artificial stimuli.

I cannot close this section, without a few remarks on the general plan of building large towns.

The ancient mode of constructing cities bears some characteristics of the age and taste of the nations, in which they were respectively founded. Most of the old cities were evidently built with reference to a state of war and robbery; being intended for safety, rather than for convenience; as appears by their narrow streets and the projections of the upper stories of the houses. The more people could be crowded into a small space, the less military force was necessary to defend the town.

However this may be, those cities were very ill-constructed for the purposes of health. Savary asserts, that 200 persons in Grand Cairo occupy less space than 30 in Paris. The streets are so narrow and full of people, that they jostle against each other, and sometimes a man is obliged to wait some minutes, before he can make his way. Letter 3. Yet this same author alleges the plague to be *not native* in Egypt! Surely a man of science need not go out of Cairo to look for causes of pestilence.

Many streets in Constantinople are narrow and crowded like those in Cairo.

The old city of London, before the *fortunate* conflagration of 1666, was in a like predicament; its streets narrow and almost closed above by the jutting of the upper stories of the houses. In the old streets, which escaped the fire, notwithstanding all the improvements of modern days, which have mitigated the violence of pestilential diseases, I am informed people are still infested with nervous and typhus fevers. London is however greatly indebted to the conflagration. In the present construction of the buildings, *one* person, it is said, occupies as much ground as *two* did before the fire. The size and arrangement of houses and apartments are also improved; and better adapted to a free circulation of air. The introduction of fresh water may also be num-

bered among the best preservatives from disease. These are among the causes of the non-appearance of the plague in modern London, and the diminution of the annual bills of mortality, within the last half century.

The plague however has disappeared in other cities of Europe, where no such improvements have been made—a curious fact, that will be hereafter considered.

But the disease continues to prevail occasionally in the eastern parts of Europe, in Hungary, Poland and Russia, which were severely ravaged in 1770, and 1771. The disease also raged at Oczakow, on the north border of the Euxine as late as the year 1739.

That part of Europe abounds with marshes and stagnant water, and consists mostly of level land. This may account for the continuance of the plague, in that quarter.

The United States unfortunately contain similar sources of disease, in number and extent scarcely equalled. Yet instead of profiting by the severe distresses which all great cities have suffered once in fifteen or twenty years, from pestilence, and guarding against the artificial causes of it, our ancestors began and we are continuing to build cities, on the Gothic plan, without more regard to the lives and happiness of our citizens, than that which was manifested by the barbarians of antiquity. The moderns however proceed on the same plan from a different motive, which is, avarice. It is now the interest of the proprietors of lots in a city, to which all the pleasure of living, and the health of citizens, are sacrificed.

We are precisely in the latitudes most favorable to the production of pestilence. In the tropical climates, constant heat soon fits the human body to sustain it, and the natives of those climates are seldom affected by the furious rage of epidemic pestilential diseases. Within the tropics *strangers* alone are sufferers by the climate.\*

\* Savary remarks "that the plague seldom reaches the polar circle and never passes the tropics. The caravans of Cairo, Damascus and Ispahan, which are sometimes infected, never propagate it at Mecca, and Yemen is safe from the plague." With few exceptions these observations are just. If the natives of cool regions pass suddenly into tropical climates, they are subject to violent fevers; but the reason assigned in the



But in the temperate latitudes, men are continually subject to the alternations of extreme heat and cold—changes hostile to the system. In winter, we may be said to be inhabitants of Lapland; in summer, of Mexico or the West-Indies. If we do not remove to the polar circles or to the tropics, yet the revolutions of the seasons *bring their climates to us*; and we annually run a similar risk with the Europeans, who pass from the northern to the southern latitudes of *perishing in multitudes*.

It is a most unquestionable fact that the northern states of America from New-York to Maine, are in a position on the globe, as exposed to the plague as the cities of Marseilles, Naples, Rome and Constantinople; and the southern states have a position corresponding with the latitude of Syria, the Barbary coast and Egypt; that portion of the earth which is *most frequently* ravaged with pestilential diseases.

If then we live in a climate in which the human body, from alternate heat and cold, is most irritable, and most subject to malignant autumnal distempers; and if a part of our country is peculiarly adapted to the production of such diseases; the most serious of all questions arises; what shall we do to prevent a frequent return of such calamities?

To me, the path is extremely plain. Our climate we cannot change—much of our country cannot be raised into hills, nor drained of its stagnant waters—the laws of nature we are unable to control in the operation.—But *our duty* is plain. Men must not plant their habitations near marshy grounds—the mode of building cities *must* be totally changed—and so must the usual habits of our citizens.

Throughout the whole Atlantic territory, on the low lands, it is more essential that large towns should be purposely constructed for health.—Great cities are usually founded on commerce, and commerce requires the access of navigable water. Hence such towns are commonly near the sea shore or on the borders of rivers.—But if they are near low marshy grounds they cannot be

text is sufficient to account for the perpetual exemption of *natrons* of hot climates from the worst form of pestilence. Their bodies mould themselves to the climate—their excitement or debility is always uniform. It is the great changes, in these respects, which expose people in the middle latitudes to the attacks of pestilential diseases.

healthful. High and dry positions, with rocky or gravelly earth, are the proper places for populous cities, on account of fresh air and good water.

But in any situation, our cities are too crowded for health or comfort. Lots are too small—too many people are crowded on to a little space of ground. A family to every lot of 25 or 30 feet by 80 or 100, cannot fail to generate too much filth, and to vitiate the air in too great a degree, for the health of the citizens. In every large town in the United States, however remote from marsh, and however healthy its position, the effects of crowded population are obvious, every autumn, in the sickness and death of *children*. Multitudes and multitudes of lives are annually sacrificed, in all cities, to the avarice of the original proprietors of lots. The little narrow dirty houses, kitchens and yards surrounded with high fences, excluding air and vegetation; all that can dissipate or absorb the noxious exhalations; all that can purify the atmosphere and refresh the exhausted frame of a human being, panting beneath a sultry sun—every thing in our cities is contrived to *waste the powers of life, and shorten its duration*.

Men, in this respect, are infinitely less sagacious than *irrational* animals. Instinct guides the beasts of the field to the most proper habitations—and they never reside where they are *annoyed*. But man, with all his boasted reason, sees the effects of his folly, and hundreds and thousands of his fellow-citizens falling victims to his own neglect, his mistakes or his sordid principles; he heaves a sigh in August and September, as he views the sable hearse, conveying his friends in scores to their graves; in November he shrugs his shoulders and says, *it is all over*; runs to the circus, the theatre and the card room; laughs away the winter's evening with his jovial companions, some of whom are destined, the next season, to fall a sacrifice to the same folly and neglect, and to fill new ranges of graves by the side of the victims of the preceding year.

In the United States, every thing that has been done hitherto in the construction of cities, is in imitation of the old European and African mode, and of course is *wrong*.

The ancient construction of London cost that city nearly *two hundred thousand* lives in one century; and Cairo and Constantinople probably lose more than that number, every half century. I firmly believe, and my belief is founded on the uniform operation of established laws of nature, that a *perseverence in our present mode of building cities, will doom them all to the same fate.* I believe it, because I see no possible reason why pestilential diseases should not be as frequent and as fatal in America as in the old world, under the operation of similar local causes.

If a rigid police can be uniformly observed; and every possible nuisance be removed by shovels, brooms and water, cities in healthy positions, will escape the regular and constant return of malignant epidemics.—Multitudes of lives may be saved, and the loss of business prevented, by these means; and in cities already built, cleansing, washing and purifying, are the guardian angels of public health.

But I maintain that this is not exterminating the root of the evil. Cities may be built so as to unite all the utility of a town, with the salubrity and pleasures of the country, and in this new world, where men are as free to act as to think, it will be dishonorable not to invent and execute a plan for these purposes.

Were I called upon for a plan of a city, which should combine in it the advantages of town and country, I should suggest the following as the outline:

1. The position to be on the shore of the sea or the bank of a river, gently ascending with an angle of at least fifteen or twenty degrees; which would form a declivity for a rapid descent of water to wash the city; at the same time, would not prevent the draft of heavy loads from the river or ocean.

2. The wharves on the water should be extended beyond low water mark, that no part of the docks should be left bare by the recesses of the tide. All the solid front of the wharves should be on a line; that no eddies might be formed; and the water might flow in a passing current. This would carry off substances thrown into the water, and contribute to keep the air pure by motion and change. Should it be necessary to extend wharfing in one place further than in another, it should be in the form of a bridge on piers.

3. The warehouses on the wharves should not be jumbled together in a chaos; one projecting in front of another: but built in a strait range, at a suitable distance from the water; and an alley should pass between them for the admission of fresh air on every side. No wet cellars should be permitted.

4. The streets should be strait, intersecting each other at right angles, and forming the city into squares of at least 500 feet on a side.

5. The lots should be at least 60 feet wide, and 250 feet long. No more than 35 or at most 40 feet of the breadth of the lot to be ever covered with buildings, so that a space of 20 or 25 feet should intervene between the houses. This space would leave a cartway, give free admission to air, and reduce the risk of fire 75 per cent.

6. In the rear of the front building, out-houses might cover 100 feet of the length of the lot. The remaining 150 feet should be laid out to the fancy of the owner in a garden—the police interfering no farther than to require by law that some kind of trees or vegetables should occupy the space—vegetation being the natural purifier of the air.

7. Directly thro the center of each square, should run a narrow street of about 25 feet taken out of the rear of the lots, which street or alley should never be built on, but would admit a passage for citizens thro the squares; and what would be still more necessary and useful, would admit dust-carts to take up all the filth of the houses, from the rear, and prevent that intolerable nuisance, the depositing of offensive materials in the streets. The little flower gardens and shady lawns in these squares, would preserve the air pure, fresh and cool in summer—they would occupy many persons of delicate health, thus contributing to their comfort, diverting their minds, and in many cases, restoring them to health. Here also children would find room to gambol, without endangering their lives or annoying passengers in the streets; and here the young of both sexes would acquire a taste for gardening, for botany, and the delightful amusement of studying the works of nature.

8. The streets should be one hundred feet in breadth, and



planted with three rows of trees. One row on each side next the foot walks, and a row in the center. The foot walks to be 15 feet wide. The trees next the walks would then be 15 feet from the houses; and a space between the center row and each side row, of 35 feet. The trees might be so pruned, as to prevent their injuring the buildings, and their distance would prevent their interfering with fire engines. These trees would be leafless in winter, when the sun is acceptable; and in summer would sweeten, purify and cool the air. The citizens at all times in the day, would walk in a refreshing shade—the center row of trees would furnish shade for horses.

9. No city should be raised on level earth. If a natural position cannot be found, with a general declivity to the water, the streets should be thrown into artificial elevations of at least 3 feet in every hundred—five feet in the hundred would be better. This would give celerity to the water falling in showers, and wonderfully assist in removing filthy substances from the streets; for after all human efforts in sweeping, much offensive matter will remain, which water alone will reach and carry off.

10. No pains should be spared to supply a city with fresh running water.

It is a point of infinite importance that citizens should not depend on water from pumps in the city. In a few years, the subterranean water becomes impregnated with the noxious particles from vaults—and this evil continues to increase with the age of the city. One of two remedies are to be provided—either the city must be supplied with fresh water by pipes from a distant source; or the vaults must be so formed as to be capable of being opened in winter and cleansed. But the last method, tho useful and practised in some European cities, would be ineffectual.

The back houses in a city are, in many respects, a terrible nuisance. If a sewer could be carried four or five feet under ground, and every such house be set over it, a stream of water passing thro it from a distant source, would be an excellent means of cleansing a city from this source of disease. But such streams of water are rarely to be obtained.

Another expedient suggests itself for the same purpose. Let a sewer of three feet wide and well paved, be run in a strait

line under the rear of the lots, and all back houses set over it. In suitable places, let channels be made to turn the water from the streets into the sewers, in long or violent showers, when the water is not wanted to wash the streets. In this manner, the sewers might be washed perfectly clean, a number of times every summer, and the citizens preserved from their poisonous exhalations.

On a model of this kind, I conceive cities should be constructed in the *most healthy* situations ; for a crowded population, in any place on earth, will lessen the salubrity of the air. Close compact cities, in any quarter of the globe, are the graves of men. All the great cities of Europe require annually some thousands of strangers to supply their waste of population. Yet there is no necessity for men to crowd together in such a compact form. There is land enough on earth to suffer any extension of cities, and it makes little difference, in the first instance, whether a lot contains one hundred feet of land or half an acre. Nor would a less dense population be any inconvenience to men, in business. They might be obliged to walk further on some occasions ; but in the cool shade of my proposed city, this would be a pleasure rather than a toil.

It is wrong, it is criminal, for legislatures to permit such crowded population. It is a nuisance, not only to cities, but to the public. It is a truth, that numbers of lives are sacrificed almost every year, among worthy country gentlemen, who have business in our large cities.

They come to town in the hot season, when no uncommon disease prevails among the citizens who are innured to the air—they come without suspicion—they are seized with fever and die. The air of the low grounds in our cities, even in healthy seasons, is often poison to people from the country, and gives them a fever, when no epidemic is visible among citizens. I know the fact, and it is a serious calamity, especially to seamen. The low grounds in Providence, New-York, Baltimore, &c. are great nuisances. The building of Water-street and Front-street in New-York, it is believed by good judges, has cost this city a thousand lives in five or six years. I say nothing of Philadelphia ; for its position and the alterations in the original plan of

the city have doomed it to calamity. The citizens will not believe the evil to arise among themselves and therefore must be left to their fate. If remitting fevers every year, and yellow fever often, will not convince men that something is wrong in their city, it is in vain to reason with them. Of one thing I am confident, that if all the earth in New-York on which Water and Front-streets are built, could be sunk 30 feet under water without loss of lives, and the proprietors indemnified by the citizens, it would be the greatest blessing which heaven could in mercy bestow on the city and the state. I believe also, that if all the cross streets and the back houses in Philadelphia could be levelled with the earth, and the ground converted into flower gardens and grass plats, the citizens would, in twenty years, celebrate the anniversary of their destruction, with as much fervor as the republicans in France celebrate the demolition of the Bastile.

It is not possible, I speak it with zeal and confidence; it is not possible, under the operation of the present laws of nature, for men to be healthy in many of our cities, during the heat of summer. That open champaign country, which regularly produces intermitting and remitting fevers, will, when planted with populous cities, often produce the plague. Of that country, there is an extent in the United States, of more than one thousand miles in length, and from 40 to 60 in breadth.

All the shore of the Atlantic from the Hudson north-eastward will admit of healthy cities. If the commercial towns on that portion of America were constructed on the foregoing plan, I would answer for it, that they would never be ravaged with yellow fever. Individual cases might occur; but the disease could not, without a miracle, become epidemic. But as our towns are now built they will at times be partially affected. In ordinary seasons and with a vigilant police they will escape, with the yearly loss of only ten, fifteen or perhaps fifty citizens, the unfortunate victims of the negligence, the folly, and the crowded population of cities. In very unfavorable seasons, the number of victims will be increased. Such is the fate of our northern cities.

But the destiny of cities on the southern Atlantic shore, is to be more severe,

The period of general contagion may subside; and intervals of more general public health, may be expected. The most unhealthy parts of the earth enjoy such intervals, when the rage of malignant complaints is suspended. But the melancholy periods of epidemics will often recur—and as the plague, in all its shapes, is the offspring of *causes*, mankind, wherever those causes exist, are destined to be afflicted.

Away then with crowded cities—the 30 feet lots and alleys—the artificial reservoirs of filth—the hot beds of atmospheric poison. Such are our cities—they are great prisons; built with immense labor to breed infection and hurry mankind prematurely to the grave.

There is no necessity for this destruction of human life. Cities laid out on my plan would unite all the pleasures of country villages, rural seats, and commercial towns. The merchant, in his ordinary business, would enjoy the grateful shade of oaks and elms, with the luxuriant perfumes of odoriferous flowers. At the same time, this verdant city would supersede the use of solitary country-seats in summer; and thus save the expense now incurred of possessing a town and country house. The country seat of a merchant, is a tax of ten, fifteen or twenty thousand dollars, paid to maintain the poison and pestilence of our present cities.

It is remarked by Boyle and other authors that China is rarely affected with the plague. The pestilence of 1347 is said to have commenced in that country; but it seems to be agreed that China and some other Asiatic countries are not often affected. This fact, if just, deserves investigation; in particular ought philosophers to examine the nature and properties of the soil and the mineral productions.

China is a very populous country, filled with canals, and well cultivated. It is probable that the water in the canals is never stagnant, nor filled with vegetables—it is probable that the face of the country has been completely dried by cultivation, all swamps and moist ground is drained and covered with corn, rice and grass. How much these improvements have contributed to preserve its inhabitants from pestilence, I need not inform my readers.



The cities also in China are vastly large and populous ; and an enquiry will arise, how those cities escape the plague, if great population contributes so much to the calamity.

I answer, they do not escape all plagues—some of the most violent have ravaged China ; but they probably escape the slighter plagues, which are the most frequent ; and this is all that mankind can expect.

We are not sufficiently acquainted with the soil, climate, police and manners of China, to speak with certainty on this subject ; but one fact ought to be mentioned. The Chinese houses have no windows in front, on the street, but in the rear, are spacious gardens filled with trees, vegetables, flowers, and fresh streams of water. Here the family is regaled and amused ; the air is rendered pure by cultivation, cleanliness, and the particles exhaled from growing plants, and water-falls. This arrangement alone will account for their exemption from the usual diseases of hot climates.—When the Americans, with their boasted light and science, shall become as *wise* as the Chinese, they may expect to share in the exemption.

It is a fact related by Ruffel and others, that in the midst of the Turkish cities, during a desolating plague, the spacious mansions of the wealthy Turks, which are kept clean, and well aired, often escape the disease.

I cannot leave this deeply interesting subject, without relating an anecdote from antiquity, which shows in what light wise men formerly viewed it.

In Greece, the countries of Attica and Lacedemon, consist of dry, gravelly or rocky land ; and I can find but one instance, in which those countries were affected by pestilence, in the early ages. It is evident from Thucydides, that the plague had never been known in Athens before his time, since the date of the earliest traditions ; and then it was probably induced principally by the croud of people collected in the siege, to escape the ravages of the Lacedemonians.

Boeotia, on the contrary, was more frequently visited by pestilence. To account for this, let us know what was the situation of this country. It is thus described.

Bœotia may be considered as a large basin, surrounded by mountains, the different chains of which are connected by high grounds. Most of the rivers from these hills unite in Lake Copais, of fourteen leagues circumference, which has no apparent outlet ; but, it was alleged by the ancients, to have subterranean passages into the sea. The country is not without hills, but is mostly level, and very fruitful. The air in Attica is remarkably pure ; but in Bœotia, very dense ; hence the ancients derived the heavy, phlegmatic character of its inhabitants from the air. This country seems to have been to Attica, 'what Holland now is to France.

See Travels of Anacharsis, Ch. 34 and the authorities there cited.

From several passages of history, it appears that Bœotia was more frequently visited by pestilence than Attica. This we should expect from the difference of their situations.

Justin, lib. 16. ca. 3. informs us, that the Bœotians once consulted the Delphic Oracle, how to remedy the plague that troubled them. The Oracle replied, " That they must plant a colony in the country of Pontus, sacred to Hercules." But they were so much attached to their own country, that they disobeyed the injunction ; until another calamity, war, drove them to consult the Oracle a second time, when, receiving a similar answer, a part of the people removed to the borders of the Euxine, and founded the famous city of Heraclea.

This Oracle certainly understood the cause of the evil, and directed to a suitable remedy. The answer implies, " you must thin your population," or " you must seek a more salubrious climate," or it might comprehend both these ideas. The direction is full of wisdom, and is strictly applicable to many of our American cities. Translated into the language of our circumstances, it runs thus " thin your population, by spreading your citizens over a larger extent of ground, or you will often be driven from your cities, into the country."

We have Moses and the prophets, in books and experience, and if we will not listen to them, neither the Delphic Oracle, nor a messenger from the thousands of dead who have perished by the plagues of our cities, would induce belief or effect a reformation.

## SECTION XVIII.

*Of the disappearance of the plague in some parts of Europe, and of new diseases.*

**I**T is a common remark that no plague has appeared in England, since the year 1665, and that the disorder has ceased in the west of Europe, for near a century past. This happy exemption from that horrible calamity has been ascribed to various causes. Many people ascribe it to health laws—a subject that has been already discussed. Some allege that the use of fossil coal has banished the plague from London; and Hoffman relates that Halle in Germany, which used to be afflicted with malignant fevers, has been free from them since coal has been used as fuel. Others suppose that the great improvements in building and in the modes of living, in modern times, have been the means of preventing the return of pestilence.

On the first cause, I have already given my opinion, and the reasons on which it is founded. I find no sufficient evidence that health laws ever saved a country or city from pestilence, in a single instance; but abundant positive proof of their utter inefficacy, in a great number of cases.

With respect to the use of coal, we ought not to indulge very sanguine expectations. It may be true, that violent diseases became more rare or wholly disappeared, in some places, about the time that coal became of general use as fuel. But let us examine facts, and not trust to general cursory observations.

The digging of coal at New-Castle for fuel commenced as early as the year 1234, as appears by a charter of Henry III. and how much earlier, is not known. It was used in London as early as 1379, in considerable quantities; but when first introduced, does not appear. In 1550, coal was in common use

in London—its price “twelve shillings a load.” The price in 1590 was raised to “nine shillings a chaldron,” which was deemed exorbitant. Thus far we have little light on the subject; but in 1615, the coal trade occupied four hundred ships; *two hundred* of which were employed between London and New-Castle. The present number is *five hundred*, and London contains more than double the inhabitants it did at that time.

See Anderson's Com. vol. 1. and Fleetwood's Chron.

In 1615 then the use of coal must have been general in London, and for some time before, for the growth of the trade must have been gradual. But for fifty years after this general use of coal, London was afflicted by the plague; the city indeed was rarely free from it, as appears by the bills of mortality, and three times, after that period, the city was ravaged by that distemper, as an epidemic, viz. in 1625, 1636 and 1665.

So far we have no encouragement to hope for a prevention of the plague by the use of coal. With respect to the city of Halle, I can say nothing. The observation of Hoffman may be just, and yet coal may have had no influence in checking the prevalence of pestilence.

It belongs to physicians to ascertain the effect of the vapor from this fossil substance on human health. Certain it is, that it occasions inconveniences to those who are not accustomed to it. So general was the prejudice against it, when first used in London, that in the year 1400, the nobility and citizens petitioned the king “to prohibit the further use of so noxious and unhealthy a kind of fuel.” And. Com. vol. 6. Ap. 935. There is reason to believe it is not very unhealthy, but I see no ground to suppose it has had the least influence in arresting the progress, or preventing the return of the plague.

To confirm this opinion, I would mention that the plague disappeared in France and other parts of Europe, about the time it did in England; in Paris, for instance, where no coal is used. In a great part of Europe therefore the same effect has taken place, without the supposed cause; which leaves us at liberty to reject that cause.

The third reason assigned for the cessation of the plague, viz.



improvements in building houses and cities, and in clothing, diet, the use of fresh water and the like, is a just one; and there can be no rational doubt that these alterations have contributed to mitigate the violence and restrain the progress, of many acute diseases. Pestilential epidemics are probably less frequent within the last century, at least in the more civilized and commercial parts of Europe, and also in America, than they had been in former periods.

The poverty, the filth, the dirty, crowded mud cottages, and the scanty supply of wholesome food, which was the common fare of the peasantry, in Europe, must have given origin or currency to many diseases; and greatly aggravated their severity. A sample of this may be seen in the early appearance of mortal diseases in the low narrow streets and small crowded apartments now occupied by the poorer people in our cities, and the difficulty of expelling a pestilential disease from such places.\*

As a general remark it may be alleged with great probability that Europe has derived no small benefit, in regard to public health, from the following circumstances.

First. From the modern improvements in agriculture, by which means many places are dried and sweetened, which used to be cold, damp and fetid.

Agriculture not only removes, from the earth, substances positively noxious to health; but covers its surface with growing vegetables positively salubrious. This is one instance of multi-

\* The following extracts will show the state of cities and of manners, at the periods mentioned.

"Westminster and London were once above a mile asunder. The union with Scotland in 1603, did not a little conduce to make a union of London and Westminster; for the Scots greatly multiplying here, nested themselves about the court; so that the strand from the mud walls and shutebed houses, acquired that perfection of buildings it now possesses."

*And. Com. vol. 2. 285. from Howell.*

Voltaire says, about the year 1500, "Industry had not yet changed those huts of wood and plaster, of which Paris was composed, into sumptuous palaces. London was still worse built, and peers of the realm carried their wives behind them on horse-back."

In 1504, when James IV. of Scotland was married to Margaret, daughter of Henry VII. of England, the princess made her public entry into Edinburgh, riding behind King James on a pillion.

*Henry's Hist. Britain, vol. 6. 597.*

This princely custom is still preserved in New-England; where the common farmers live in better houses than many of the nobles, at the period above named.

tudes, in the economy of the world, in which the happiness, comfort and interest of man are made to depend on his industry.

See Dr. Rush's Works, vol. I. p. 25.

Secondly. Improvements in building houses may have contributed to the same salutary end. The materials are of a kind less susceptible of accumulating and retaining infectious exhalations, than formerly—the apartments are more spacious, elevated and airy.

Thirdly. Houses are less crowded than in ancient times, as appears by the proclamation of Queen Elizabeth, recited in the foregoing history. In London, one person, since the fire of 1666, is supposed to occupy as much space as two in the old city. This remark applies especially to the poor, who were formerly more numerous than at present. Some of the nobles, in the old city, had spacious gardens, but the mass of people were miserably poor and crowded into narrow filthy lodgings.

Fourthly. There is probably an immense difference in regard to general cleanliness, between the people even of the sixteenth century, and the present age. For this we are partly indebted to commerce, the source of wealth and refinement. A more general use of linen and cotton in cloathing, articles which require washing frequently, may have contributed to the same object.

Fifthly. The introduction of pure water into cities from distant sources, and a liberal use of it, in houses, and the streets, have aided in the same salutary work of diminishing the calamities of disease.

Sixthly. It is believed that the modern diet is more friendly to health than that of former times. It is evident that to this change Europe is much indebted for the disappearance of scorbutic complaints, which formerly were epidemic in Holland and other parts, and which still prevail in Iceland and Canada, where the poor live mostly on dried or salted fish, poor flesh meats, with a small portion of vegetables. The cultivation of the vine and the orchard has doubtless had a considerable effect. Cider and wine have assisted in preserving the body from debility in certain pestilential periods; and when temperately used, are of excellent use.

But I apprehend that the moderns have ascribed too much to these causes. Any man who will read history with care, will observe that there has been, within about a century, a considerable abatement of pestilence in all parts of the world. The plague is far less destructive in the Levant, and Egypt, within 150 years, than it was in former ages. This mitigation has been cotemporary in all parts of the earth, of which we have any correct knowledge. The cause of this change, I pretend not to assign; but a similar abatement has been observed in the violence of earthquakes.

While I admit however that the true plague has disappeared as an epidemic in many parts of Europe, I do not admit that *pestilence*, in the general sense of the word, has wholly disappeared. If the true plague, technically so called, should never again occur in London or Paris, I should then say, that improvements in modern times may have *mitigated the pestilence*, but not that they have wholly banished it. Under this word pestilence, I include small-pox, anginas and petechial fever, with other malignant disorders, which evidently depend on the same general cause as the real plague, operating with less force. These diseases still appear in all parts of Europe, and exhibit the *existence of the pestilential principle*, altho improvements may have *lessened and circumscribed its effects*.

I do not however consider it as certain that the true plague will not revisit all the western parts of Europe. A concurrence of causes, like that in 1348, might again produce that disease in France, England and Ireland, with all its horrors. But the probability is, that the modern improvements have removed so many of the *local causes* of disease, that no constitution of air will ever again produce the same mortality, as that under Vortigern or that under Edward III; nor will the plague ever again be so frequent, as in former ages.

On this point however there is not sufficient ground to build any certain calculations, for the following reasons. Every physician and historian well knows that there have been frequent revolutions or changes in the form of certain diseases—ordinary diseases with new symptoms, and diseases before unknown, have appeared in various countries and in all periods.

The most remarkable of these are the small-pox, venereal disease, sweating sickness, Hungarian fever, petechial fever and angina maligna, with some of less note.

I am not about to enter on the great question, when or how particular diseases have been introduced or modified in their symptoms. I suspect however there is a fallacy in the common theory about *new* diseases. What are usually called *new* are more probably nothing more than the changes that are made in former diseases, by alterations in the atmosphere, climate, habits of living and a multitude of inferior causes. The small-pox and the venereal disease seem to have the best claim to the appellation of *new*; yet the fact of their being unknown before the periods assigned for their appearance, has been justly called in question. See note at the end of this Section.

Certain diseases however appear in particular countries, where they had not before been known, since the date of the earliest histories. Possibly some have been propagated by infection; others have evidently arisen from some general cause. Thus Pliny relates that the elephantiasis was brought from Egypt into Italy, by Pompey's troops, but soon disappeared. It is said also that the same disease was propagated in the west of Europe by the Crusaders. Epidemic scurvy appeared in the maritime parts of Holland in 1556. The petechial fever which desolated Spain in 1557, and afterwards all Europe, was called a *new* disease, different from the usual purple fever, and said to be spread from the islands of the Levant through Italy to the west of Europe. The angina maligna, in Spain in 1610, was called there a *new* disease; and in England, where it appeared about fifty years ago, it has been called a new disease in that country.

But the real state of the question seems to be, that epidemic diseases, most or all of which proceed from qualities of the atmosphere, suffer general changes, in conformity with the revolutions and alterations which take place in the physical world. A remarkable instance of this, was the sudor anglicus, which was, in its general symptoms, the plague; but some general cause in England first and afterwards on the continent, superadded a peculiar symptom, that of profuse discharges by the pores. This character of the disease, as has been well observed by the



author of *Traité de la peste*, was the effect of a species of revolution in the form of pestilence. Infection or contagion can have had no concern in producing this phenomenon. The disease maintained this peculiar character from 1483 to 1551, a period of almost 70 years, raging occasionally in most parts of Europe and then disappeared; at least it has never made considerable ravages since that time.

This, in medical language, was a *new* disease, as demanding new modes of treatment; but in the language of philosophy, it was only a varied form of the same malady, and proceeding from a common cause, with the inguinal plague, but that cause in particular times and places, was modified in its operation. What confirms this idea is, that this sweating disease never appeared as an isolated epidemic, but was always cotemporary with the common plague in other countries—that is, it formed a part of the general effects of the pestilential principle. Thus in 1483, about the time of its first occurrence in England, all Europe was desolated by the common plague. Denmark lost half its inhabitants, and many other countries fared very little better. The same may be observed of its subsequent returns, and of its prevalence in Ireland, Holland, France and Germany.

This is what I call a revolution in pestilence, and it will apply to many other changes in the predominant diseases of the human race.\*

Thus the petechial fever, which ravaged Europe in the sixteenth century was called a *new* disease; but I conceive it to

\* It astonishes me to read in modern books the positive assertions, that the plague is never generated in Great Britain, or other northern latitudes." See Mead, James' Medical Dictionary, Cullen, Encyclopedia and other original works and compilations without number. Lord Verulam, Sir Thomas Moore, Boyle, Erasmus, Diemerbroeck and other luminaries of former centuries, who saw the plague frequently in all its varieties, never pretended that the disease was not produced in their respective countries. The *sudor anglicus*, not only appeared first in England, but for the first time of its prevalence was confined to Englishmen. Yet this was the most violent and destructive form of the plague that ever has been known.

"Nuper novum pestilentie genus immisit Deus, letiferum sudorem, quod a Britannis exortum, incredibili celeritate, per orbem longe lateque divagatum est—plurimum exitio, summo terrore omnium."

*Life of Erasmus, 347.*

How respectable writers can overlook such authorities is to me inexplicable.

have been no more than a varied form of the common purple fever, induced by some general variation in the elemental cause of epidemics, or by the seasons. It formed a part of the pestilential series, and was the precursor of the plague, as it is to this day, altho it has rarely been so general or fatal as about the year 1556 and from 1570 to 1576.

It is remarkable also that the general cause extended over the Atlantic, and gave the same character to the fevers of the West-Indies. The disease which reduced the forces of Sir Francis Drake at Carthagena, in 1586, was called *calenture*; a species of malignant spotted fever.

Purchas, vol. 4. 1182.

A similar fever infected the people under Sir Thomas Gates, bound to Virginia, in the beginning of the last century. And if Ulloa is correct in stating that the infectious yellow fever never appeared at Carthagena, till about the year 1730, we have a remarkable proof of a revolution in the diseases of that climate. We are to conclude from the facts, that the *calenture* was a distinct form of the pestilence incident to the country, till the beginning of the present century; since which, it has assumed the character of our bilious plague. I am however inclined to question the fact. The true yellow fever has been known in the English islands from their first settlement. It reduced Cromwell's forces when they took Jamaica in 1655.

It is further to be observed that the true form of plague is never known in Spanish America. But at Quito, and other places, malignant distempers under the name of *spotted fevers*, and pleurisies, sweep away prodigious numbers of people and fall but little short of the inguinal plague.

Ulloa, vol. 1. 279—281.

Such then is the pestilence of South-America; but in other periods, it may take a different form.

These observations also lead to an explanation of the phenomena of the angina maligna. It was called a *new* disease in Spain and England, when it first appeared in 1610; but this is a mistake. It is evidently described as epidemic a century or two before those periods. But the truth is, *that form* of pestilence had disappeared for a long period and given way to some other

disease. After a time, it re-appeared, perhaps with some new symptoms.

The same remarks apply to the Hungarian fever, the peculiar symptoms of which first occurred in the sixteenth century; and to a multitude of local and temporary epidemics, which have been called, on account of some singular symptoms, *new diseases*.

These facts serve to explain my idea of the disappearance of the plague in certain parts of Europe. I consider the *angina maligna* as pestilence of the worst kind; and its occurrence in modern times, since the glandular plague is less frequent, may be only one of the revolutions in diseases of a malignant type, which have marked other periods. The destructive force of the pestilential principle, falls principally upon the throat, instead of the brain or the glands, and mostly upon youth. This may be the principal form of pestilence for a century or two, when it may disappear and give way to the common plague, or to some new combination of symptoms, which shall pass for a *new disease*. A conjecture of this kind is authorized by several changes in the general characters of diseases, at particular periods of the world. I do not therefore consider it to be *certain*, that the parts of Europe, which have escaped the plague for a century, are secure of permanent exemption from that calamity.

This conjecture seems to be authorized by the evident mitigation of the plague in the Levant, within a century. Plagues, it has been before observed, are obviously less frequent and less severe, in Egypt and Turkey, than they were in former ages. This remark I believe to be new, but it is a fact; and this mitigation corresponds in time with the disappearance of the disease in the healthy parts of Europe. From this circumstance, I conclude that this change is the effect of some general cause, in the state of the elements.

This opinion may derive great strength, from revolutions or changes in the natural world, analagous to that in the character of epidemic diseases.

It is generally supposed by philosophers, that earthquakes are less frequent and violent, in modern days, than in the first centuries after the Christian era, and the imperfect survey have

taken of their history, gives me reason to believe the opinion well founded.

The eruption of volcanoes is very often suspended for a long period. Etna was quiet about forty-five years, at the beginning of the present century. The volcanic mountain in Teneriffe, which had been quiet ever since the year 1704, again discharged its fires in August last—after a suspension of ninety-four years. There are other volcanic mountains that have slumbered for many centuries, as Lipari, near Sicily.

The aurora borealis has its revolutions. Sometimes it disappears for half a century or more ; then returns, and frequently illuminates the heavens.

The seasons, on a smaller scale, manifest analogous revolutions. At certain periods, we have mild winters ; very little frost and snow, with southerly winds, for a series of years. Then we have a number of long, severely cold winters in succession, with violent tempests, deep snow, and perpetual north westerly winds. No less various are our summers, as to heat and moisture.

The vegetable kingdom exhibits similar changes, for which no visible cause can be assigned. When our ancestors first settled Massachusetts, they raised wheat on the eastern coast, in the counties of Plymouth, Middlesex and Essex ; but in the year 1664 mildew appeared for the first time to injure that useful article, and since that time, it has not been possible to raise wheat, within a considerable distance from the sea shore.

It is related by the French that wheat had not been known to mildew in France, until the year 1550.

Van Helmont, p. 1093.

In 1770, the potatoe plant, in a particular part of Scotland, was attacked by a disease which was new ; and it has since been spreading. A similar fact is related of the oats in some parts of the same country, in 1775. These diseases, for they are really such among vegetables, are new, and as far as they extend, they are a serious calamity. They are the pestilences incident to vegetable life ; which, like diseases among men, spring up and disappear, without any certain causes which are within our compre-



hension. It is customary to ascribe such phenomena to the *seasons*; but it would be difficult to find any *visible* or *comprehensible* qualities in the particular seasons, producing such diseases among vegetables, which had not characterized innumerable seasons in former years, which produced *no* such effects.

The death of prim and black thorn in our country, is a similar phenomenon.

Sometimes a new species of tree will spring up spontaneously and gradually spread, where none ever grew before. The pine has thus introduced itself into Duxborough in Massachusetts, within the present century. Not twenty years ago, a man was living there who remembered the first white pine that ever grew in that town: but now one eighth part of the woodland is covered with it.

Hist. Cal. vol. 2. 5.

The animal world displays similar changes and revolutions. We observe, not only uncommon numbers of common insects or small animals, in particular years, for which we can assign no specific cause; but we actually see certain new species of insects, and at times, known insects grow to an uncommon size. Instances of the latter phenomenon have occurred in the locusts, in the frog-kind, and in flies. The flies about Plymouth in 1633, and about New-London, the last summer, are described, as being not only distinguishable for their numbers, but for their size. Ancient authors have remarked the same phenomenon.

The millions of worms which spread over many hundred miles of territory in America in 1770, can no more be accounted for, than the sudor Anglicus, or any other new form of disease.

The insect, which about twenty years ago, first appeared among the wheat, on Staten-Island, and which has continued to multiply, and essentially injure the crops, over a great extent of country, is unquestionably a non-descript as to America; a new form of animal life. Men are ever fond of propagating conjectures and vulgar tales for truth. The idle story which imported this insect from Germany, and gave it the name of Hessian fly, has been proved, by careful enquiries, to be mere conjecture; no such animal being known in Germany. Yet it has laid the foundation of a durable error in natural history. So fond are man-

kind of this vulgar prejudice, of imputing all their evils to others, that even insects must, like plague, be imported !

This insect is doubtless a new species of animal ; it is one of those varieties which nature is continually exhibiting, in the immensity of her operations ; it is a distemper incident to that particular plant, and others perhaps in a less degree, which, like the *fudor anglicus* may endure for half a century, and then disappear ; or it may be derived, from permanent causes, and destined, for a longer time, to annoy that species of vegetable life, like the mildew on the same plant, on the maritime borders of Massachusetts and New-Hampshire. The mammoth of Siberia and America, whose enormous bones are seen in our museums, and whose race is supposed to be extinct, may be another instance of perpetual revolution in the works of nature.

The lofty pine, the glory of the forest, covers immense tracts of our native wilderness ; but when cut down, is not propagated from the roots or stump, like most other trees. Yet I am told that in Carolina, whenever the lands are cleared of the native woods the young growth consists mostly of pines, tho' far from any of that species of tree. Similar changes in the species of trees, are observed on the clearing of lands in other parts of America.

So also, on clearing our lands, in every part of America, the soil is soon covered with a full crop of white clover, of spontaneous origin.

These productions are usually ascribed to the seeds of the plant, scattered by birds, which lie inert, while covered with shade and leaves, and germinate on the access of the solar rays. This solution is conjectural ; it is, like the importation of the fomes of epidemic diseases, founded on mere supposition ; it is the resort of careless, superficial observers, who will not take the pains to extend their views over the works of nature. Do birds convey the seeds of pine and of clover and spread them over hundreds of miles of the wilderness ? Have these seeds been all scattered within a few years ? Or will the seeds endure the frost, the rain and the heat of ages, without perishing or germinating ? Besides, birds feed on the seeds of other grasses and plants, as well as

those of white clover. Why are these not spread over our woods in the same manner?

The phenomena of the forests in America preclude the probability, or rather the possibility of such events. The new plants that spring up, are generated by new powers in the elements, occasioned by different combinations of heat, moisture and air, introduced by the labors of man; combinations which could not exist while the ground was clothed with trees of other species.

Plants are furnished with seeds for the purpose of propagation. This wise provision of a beneficent providence, is highly useful to man, and to animals which subsist on the seeds. But seeds are not necessary to the production of plants, in all climates. Every vegetable has some spot on the globe, where it is indigenous, where it was originally produced without seed; and where it will best thrive, and grow to the highest state of perfection. Such was the origin of most of the plants now known to man. The principles of animal and vegetable life were cotemporary with the formation of the earth. New species are generated only by those gradual alterations visible in the operations of nature, or by accidental changes, induced by extrinsic and artificial causes.

Animals are also produced very often without any parent, but the elements. Hear what is recorded by that accurate observer, Dr. Lind, on the diseases of hot climates, p. 208. "It is a phenomenon incontestibly true, that in stagnating pools of water at Bombay, produced solely by the rains, and which have no communication with any river or the sea, living fish are generated; many persons have eaten of them. Upon the drying up of the pools, they die and frequently are very offensive."

I have not the least doubt of this fact; and it is on this principle only that we can account for the existence of fish of various kinds, eels, &c. in brooks and ponds, on the tops of hills, above impassible falls; and in lakes which have no outlet. And we prove the generation of such animals in the places where they exist, not only by the impracticability of their finding a passage to such situations; but by the fact, that many species of them are never found in salt water, and probably could not exist in it.

Any person may be convinced of the utter impossibility of fish's making their way to the heads of many small streams, where they are found, by examining innumerable such streams on our mountains, which are full of trout and other small fish, above perpendicular falls among solid rocks, of 50 or 100 feet in height.

The truth is, the elements of air and water are fitted to produce animals of the kinds proper to subsist in them; and so are plants. Not a vegetable in the field is found without its worm, its fly or other insect, which it generates or feeds; and the animal when peculiar to a plant, has the color and the properties of that plant. Not a species of vegetable or animal matter, exposed to a suitable degree of heat and moisture, which does not produce its insect. Even living animals are not an exception. Are not the large worms, formed in the human stomach, possessed of animal life? And are they produced by a germ deposited by an animal of the same kind? Not at all; the supposition is ridiculous. They are a disease, caused by the operation of heat and moisture, on substances in debilitated stomachs, which fail to perform the usual digestive functions. All animals and plants have their diseases; and the mildew on wheat, and the scar on vines, are probably the effect of the defective energies of the elements, and a consequent defective process in the vegetable functions; or of insects which are the produce of the irregular operations of the elements.

In the year 1788 a horse was publicly exhibited in Philadelphia, with a living animal, of the worm species, in his eye. See Museum, vol. 3, 500. A worm of three inches in circumference and 20 inches in length was found in the liver of Mrs. Holt of Philadelphia, 1bm. When these facts are known and acknowledged, will men still be found to deny the doctrine of equivocal generation? Worms are often generated in the small ulcers on the surface of the body produced by pestilence. Such is the power of excitement.

All creation is full of these varieties. Even the stellar regions exhibit new stars, either stationary or revolving, which are

This is the common theory; some persons suppose them not a disease, but a part of the animal economy, necessary to full health. This however makes no difference, as to the manner of their production.



visible for a longer or shorter time, and then recede from human view. Other luminous appearances, resembling a lamp, a spear, a beam, are often observed, for which we can assign no cause. The new stars may be revolving bodies, which appear to us only in a particular part of their orbits; but other singular celestial appearances are doubtless mere variations in the forms of the element of fire.

The fish in the ocean are subject to the same revolutionary laws. They often abandon the banks where they have appeared for centuries, and appear in places where they were never before known. They are subject to epidemic maladies, as much as men or cattle; they often sicken and die, and sometimes it appears that the whole species, frequenting a particular bank, is suddenly extinguished.

The changes in the diseases of men; all the phenomena of epidemics, in their origin and disappearance, their increased violence and novelty of symptoms, are the effects of similar alterations in the elements which compose the system. We are but one species of animals, whose bodies are composed of the same materials, and subject to the same laws, as the bodies of all other animals. Animal and vegetable substances are also composed of the same elements, variously combined; they are simply varieties in the forms of matter endowed with life. And the intellectual endowments of man, with all his boasted pre-eminence, cannot exempt him from the operation of the general laws which govern every other form or combination of the elements.

#### *Note, On the Venereal Disease.*

I AM really surpris'd to observe with what pertinacious obstinacy, men persist, in face of the most incontestible evidence, upon fathering great evils and calamities on others. The description of Adam's casting the blame of his sin on Eve, and Eve's charging the whole to Satan, had it been intended to illustrate the practice of tracing diseases to a foreign country, could not have been a more exact representation of the fact, and of the disposition of men to shift off, not only crimes, but even moral and political evils, and cast them on their neighbors. Ev-

ery nation and every man conjures up a devil, to which all that is evil and dishonorable is to be imputed. Pope has well described this disposition :—

“ No creature owns it in the first degree,  
But thinks his neighbor farther gone than he ;  
Even those who dwell beneath its very zone,  
Or never feel the rage or never own.”

The people in the north of Europe maintain most strenuously that the plague never originates in their countries. Mead even affirms that the measles, as well as small-pox, had its origin in Egypt.

The inhabitants of Egypt declare that the plague does not originate in *their* country, but is always imported from the north, as Constantinople, Smyrna, Greece or Syria ; or from the Barbary coast ; and this silly notion is actually believed and circulated by most reputable travellers. The inhabitants of Constantinople, I believe, admit that the plague *may* originate in that city ; but it is believed by many persons that this disease does not originate there ; and they trace it to Egypt. Many Europeans have adopted this opinion.

In Smyrna, Syria, Cyprus, and all parts of Europe, the plague is ascribed to foreign countries. In Algiers, Fez and all along the Barbary coast, the plague is held to be imported from Egypt or Constantinople : It is immaterial which ; the great point being to shift off the origin upon neighbors.

Just so in America ; it is not admitted by a great portion of people, that the climate can generate a pestilence. The yellow fever which is the plague of the country, is, in popular opinion, always imported from the West-Indies. When we go to the West-Indies and enquire for the origin of this disease, we are told very gravely, that it does not originate there ; it comes from Siam and Bulam ; and books are written by able physicians to prove the disease imported.

If then we believe the opinion of the inhabitants of any given country, and their *own story* to be just, we shall prove that the plague and yellow fever are generated in no country on

earth.\* There is something extremely laughable in these facts; but to philosophy, to medical science and national candor, they are as disgraceful as they are prejudicial. My enquiry into the histories of these diseases, has demonstrated to my mind, that most pestilential diseases have originated, where they existed; and no one of them will spread or exist long, in an atmosphere in which it will not originate.

The small-pox does not usually spread without infection; but I can prove, by many instances, that it does originate, in sporadic cases, without infection. In South-America, it spreads and becomes epidemic, in certain periods, then totally disappears.

Ulloa, book 6.

The venereal disease appears to be propagated solely by infection. It must however have originated at first without infection; and *may* still, for aught we know, originate in the same manner.

But the attempt of physicians to palm this disease on the natives of America, is a most gross and abominable attack on truth, persevered in against the plainest and most indubitable evidence. In the annals of England, there is the clearest proof of the existence of that disease, in the twelfth century; and it was the subject of legal provisions as early as the year 1162, which laws are still extant, and were then only a renewal of those which were *still more ancient*.

In the records of the Lordship of Winchester, there are many regulations respecting the stews which were authorized to be kept in Southwark; one of which expressly prohibits any "stew-holder to keep any woman, that hath the *perilous infirmity of* (Brenning) *burning*."†

In a book written from a manuscript about 1430, in possession of the bishop of Winchester, one article begins thus; "de his qui custodiunt mulieres habentes nephandum infirmitatem;" it

\* "But where the extreme of vice was ne'er agreed;  
Ask where's the north? at York, 'tis on the Twiced;  
In Scotland, at the Orcades; and there,  
At Greenland, Zembla, or the Lord knows where."

*Essay on Man, II. 221.*

† *Burning* is a modern orthography; the ancient was *brent*, *brenning*. So Chaucer wrote it. *Canterbury Tales*, 2427, and in other passages.

"The fires *brent* upon the auter bright,  
That it gan all the temple for to light."

goes on " item, That no stew-holder keep noo woman wythia his hous that hath any sickness of *brenning*, but that she be put out, upon the peyne of make it a fyne into the Lord of a hundred shylings."

That this was a common disease appears from the frequent mention of it in those records; and that it was the same disease, now called *venereal*, appears from the description of it given by Arden, physician to Richard II. and Henry IV. between 1377 and 1413; who speaks of it as a "certain inward heat and excoriation of the urethra."

This disease was called a *burning* and went by that name, till the middle of the 16th century.

See Philosophical Transactions, No. 357.

Baddam's Memoirs, vol. 6. 390.

It is asserted by European authors that this disease was prevalent among the natives of America, when the Spaniards first visited the country. I cannot controvert the assertion, for I do not possess the original Spanish histories of their first voyages. But it is possible this may have been true. It is somewhat strange however, if that disease was formerly very prevalent among the natives, that in modern times, it should hardly be known among them. Ulloa, in his voyage to South-America, book 6, declares that the "venereal distemper is seldom known among the natives," altho so common among the Spaniards as to have lost the infamy attached to it in other countries.

See also book 5. ch. 6.

The small-pox has been supposed to have originated in Egypt

\* These remarks on the origin of diseases proceed solely from my love of truth and sound philosophy. I am no more anxious to exonerate the savages of America from the charge of communicating the lues venerea to Europeans; than I am to vindicate Egypt from the charge of originating all the plagues that have desolated Europe. It is my wish to prostrate that system of error respecting the origin of pestilential diseases, which disgraces modern days.

The following remark is of less consequence. The British Dictionary defines the word *Buccaniers* by "Pirates of America or American Pirates." But names lead to error. The buccaniers were all originally Europeans, French and English, who committed piracies in the West-Indies and Spanish America. Encyclopedia art. *Buccanier*. Thus the name "Hessian fly" given in this country to a mischievous insect, is the offspring of ignorance and the parent of a material error in common opinion.



or Arabia, and to have been propagated over the world by specific contagion. But the small-pox, altho we know not the time or place of its first appearance, is only a *new form* of that class of diseases called, exanthemata, or eruptive. It is the produce of a *revolution in disease*, and now originates any where and every where, *without contagion*.

With respect to the origin of the lues venerea, we are left in the dark, as we are with respect to the small-pox. It is agreed on all hands that none of the Greek and Roman writers on medicine, have described the disease. But there is not a shadow of doubt that a species of this disease existed in England as early as the Norman conquest; and probably in the other countries of Europe. Not a medical work of that period, if any was written in the west of Europe, has survived the ravages of time; and we are indebted to the legal establishment of stewes in Southwark, for the evidence of the existence of that disease.

It is however not at all improbable that about the year 1496, this disease might have acquired some new and malignant symptoms, and spread with a fatal rapidity, that might alarm mankind and render the distemper more an object of notice. Antecedent to that period, it might have been much more mild and less destructive. This idea is greatly strengthened by the known fact that other diseases had, about the same time undergone similar changes. It was but about ten years before, that the plague took the *sweating* form—an event as novel, as the generation of a new disease. What is more remarkable; in the very year assigned for the appearance of the lues venerea, an epidemic leprosy overran Germany; an event equally novel. These facts confirm my ideas of certain revolutions in the symptoms of diseases, corresponding with material changes in climate or modes of life.

## CONCLUSION,

*Addressed to the learned Societies, in America, Europe and Asia.*

THE preceding history of Epidemic diseases was undertaken solely from a desire of investigating the truth, respecting the origin and phenomena of these terrible scourges of the human race. When the pestilence appeared in the United States in 1791 and 93, I had not a suspicion that the popular doctrines respecting contagion, are not well founded. The frequent recurrence of the disease in subsequent years, in opposition to all the best efforts of health officers, in executing rigid laws of quarantine, had, in 1795, shaken my confidence in those doctrines. My investigations in that and the next year, convinced me that the pestilential fever which has visited so many parts of America, is generated in the country; but still I had not the least suspicion of a connection between epidemic diseases. The investigations of the year past, have resulted in unfolding principles and facts to me altogether new and surprising; they cannot therefore be ascribed to a wish to establish a preconceived theory.

These results not only confirm my suspicions that the pestilence of America is of domestic origin, but they overthrow the preconceived system of the origin of pestilence, in temperate latitudes, from fomes conveyed to those climates from southern regions; and demonstrate that it originates occasionally in all latitudes from the 25th to the 65th.

It is demonstrated that pestilence, in temperate latitudes, is never an isolated epidemic, but the crisis of a series of epidemics; and we are furnished with the means of determining unequivocally the character of pestilence in every case, on the following simple principles.

“ If, on the appearance of pestilence in a particular place, all

other diseases cease, or take some of its predominant symptoms, that pestilence is generated in that place, and dependent on the state of the elements."

It is impossible, on physical laws, that this criterion should ever fail.

Another criterion, almost infallible, is the prevalence of certain diseases before and after the pestilence. If pestilence is immediately preceded by measles, affections of the throat, inflammatory or typhus fevers with anomalous symptoms, and especially by catarrh, that pestilence is an epidemic, produced on the spot, and only the *autumnal form of disease*—the other diseases, preceeding and following, being the vernal and hybernal forms, produced by the same general principle.

Of the pestilences which afflict mankind, in all climates, an immense proportion, probably nineteen twentieths, belong to this species—they are epidemics, beginning and ending at the command of the elements, under the co-operating influence of seasons and local causes.

These epidemic pestilences are more or less infectious, according to their violence, or the places where they exist. In close rooms and narrow alleys they are dangerous; hence their mortality in fleets, camps, jails, and particular parts of cities. But the infection of such diseases extends to the distance of a few feet only, and is capable of dissipation in a free air, so as to reduce the danger of attending the sick almost to nothing. The same is true of diseases of mere infection, not epidemic.

Diseases, dependent on infection only, are sometimes introduced into cities and hospitals, and occasion considerable mortality. But they are propagated by contact or near approach only, and do not affect the character of other diseases current in the place.

The consequence resulting from these principles is, that epidemic pestilence is not under human control—but diseases propagated by mere infection may be arrested and subdued.

The only means of avoiding or mitigating epidemic pestilence are first to withdraw the aid of local causes; secondly to fit the body, by modes of living, to resist its causes—and thirdly, on failure of these, to remove from the place where it exists.

The infection of all diseases, even those of specific contagion, as small-pox and measles, may be avoided by keeping at a distance from the diseased. The infection of diseases not specifically contagious, as plague, yellow-fever, dysentery and jail fever, may be nearly destroyed by free air, and cleanliness.

With respect to the primary causes of epidemic diseases, we are in the dark; but we are certain, from all history and modern observations, that the causes of epidemic diseases among the human race, affect every species of animal and vegetable life.

The opinions which I have suggested concerning the general cause, seem to have a foundation in the coincidence of epidemic diseases with numerous electrical phenomena. At the same time, the reader will consider these opinions rather as *conjectural*, than *positive*. No certain conclusions can be drawn from an interrupted and imperfect series of facts. More materials are necessary to enable us to erect a theory of epidemics which shall deserve full confidence.

The common doctrine of contagion is utterly insufficient and unphilosophical; for if admitted, it never leads us nearer to the cause. If we trace the yellow fever to the West-Indies, and the plague to Egypt or Constantinople, we are not an inch nearer to the source; for these diseases are not always to be found in those countries; and the people there are as much puzzled to find the source of them, as the people of Great Britain or America.

If we trace these diseases to the coast of Africa, or to Siam, we are as distant as ever from the source; for many times, the diseases are not to be found in those countries, and seldom indeed are they ever found within the tropics, except among foreigners.

Indeed nothing is more common than for the yellow fever to be imported into the West-Indies in vessels from the United States.

When vessels from northern latitudes have long passages, it often happens that seamen are seized with the disease, before they arrive at the islands; and the West-Indians may often allege the disease to be imported in such vessels, when it does not exist in the United States.



In short, the doctrine of deriving all pestilential diseases from contagion or infection, were it not for the immense mischief it does to society, would not deserve a serious refutation. Infection is a *subordinate cause* of the propagating of malignant distempers; but is itself an *effect* of some more general cause, whose force is a hundred fold more powerful and formidable than that of infection. I have, in condescension to popular opinion, stated the evidence of the domestic origin of the bilious plague, as it stands on the arrival or non-arrival of vessels, and other facts of that kind. But I really consider all this evidence as trifling, when compared with the phenomena of the disease itself and its precursors and attendants. The uniform appearance of other epidemics, as introductory to pestilence, and manifesting an essential change in the atmosphere, with the numerous accompaniments of the plague and yellow fever, amounts to evidence of domestic origin, which leaves no room for cavil or controversy.

For the purpose of collecting facts, the only safe foundation of principles, and comparing the phenomena of diseases and the elements, which occur nearly at the same time, in different countries, I sincerely wish and request that all medical and philosophical societies would undertake to register facts and reciprocally to communicate them, by means of a general correspondence. The facts to be registered might be comprized under the following heads.

I. The time of the appearance and disappearance of any epidemic disease, with its general history.

II. The places where it first occurs to be described, in regard to land and water, height of the land, construction of the city or streets, position as to points of compass, woods, morasses, &c. III. The classes of people most generally affected.

IV. The general state of the seasons, as to heat, and cold, (drouth and moisture.

V. The time of earthquakes, meteors, lumen boreale, and all singular celestial appearances—with unusual tempests, especially when accompanied with hail—all compared with the lunar phenomena.

The appearance of unusual insects of all kinds, and any circumstance attending them.

Diseases among cattle, sheep and other animals.

Sickness and death of fish of all kinds.

Volcanic eruptions, with the phenomena preceding, attending and following them.

For the purpose of ascertaining the lunar influence on the human body, or any diurnal influence, it would be desirable that medical gentlemen should note the days and the hours of the day when persons are seized with particular diseases—especially epidemics—the hours of exacerbation and of paroxysms in fever—the hours which are most fatal to the diseased—and the time when convalescents are most apt to relapse.—These facts should be compared with the position of the moon, in her orbit, and especially in regard to her perigee and apogee; conjunction and opposition; as also with the tides in the main ocean.\*

Should the principles unfolded in the preceding work prove to be well founded, they will lead to many important practical inferences.

I. If pestilential fevers never appear in the temperate latitudes, without certain precursors, men will, with careful observations, be enabled to foresee the danger and prepare for it; or to use uncommon diligence in removing the subordinate local causes.

II. If in certain years pestilential fevers are more predominant, than in others; and the condition of the elements fitted to produce them, is universal over sea and land, the fact is of no small moment in maritime affairs. Double precautions will be taken in fleets, and in merchantmen bound on long voyages.

III. If pestilence is progressive and first manifested in certain malignant fevers, the fact may be of great utility to large cities. The approach may be perceived in time to save the inhabitants by flight, if not by other precautions.

IV. If no plague or yellow fever ever appeared in temperate climates, unless announced by other distempers, the magistracy may be enabled to distinguish when there is danger, and when

\* The time of high and low water in rivers and bays may not be the true time, in the open sea—or of the greatest and least influence of the moon.

not; and may avoid innumerable vexations to commerce, arising from the rigid execution of health laws, when there is not the least occasion.

V. But a most important use to be made of the facts here collected, will be, to guard public health from the ill effects of bad provisions. If, in pestilential periods, salt is less efficacious in preserving flesh, and by means of a greater fermentation of the juices, fish and flesh are more readily dissolved by a putrefactive process, more caution will be found necessary in packing and repacking them, and more care to avoid using it in a bad state.

If the effluvia of dissolving flesh and vegetables are more poisonous and prejudicial to health at some times, than at others, it is of importance that, on every such occasion, early notice should be given of the danger.

If animals, which constitute a part of the food of men, are subject to epidemic distempers, they cannot be eaten with safety, while affected by disease. When fish or fowls are sickly and many of them die, or become lean, the fact should be ascertained by the faculty or a board of health, and public notice should be given, that people might avoid using them as food. In some instances, fish are so sickly as to excite nausea; in which case the use of them should be forbidden.

I will close this treatise with the following reflections.

In the construction of the universe, we observe every part of the system to be governed by uniform laws, adapted, with infinite skill, to preserve harmony and order. Limited as our understandings are, we can discover many of these laws, which are calculated to impress on our minds the most sublime ideas of the universal intelligence and wisdom of their Great Author.

The existence of natural and moral evils has led sceptics to question the perfections of the author of nature. But doubts on this subject argue want of knowledge or want of candor. It is extremely evident that all the necessary evils of the system are calculated to produce good. The operation of that universal principle of light, heat and fire, which pervades our system, and which is incessantly compounding and decompounding the other more sluggish materials of the earth and atmosphere, are essen-

tial to the vicissitudes of the seasons, rain, snow, hail and dew, which are necessary to preserve the principles of animal and vegetable life. Storms, hurricanes, earthquakes and volcanic eruptions, however inconvenient to men at particular times and places, are among the means of giving to the principles of life, more equal distribution, and of renewing their energies.

Epidemic diseases are some of the necessary effects of the general laws that govern the universe. But they have also a final cause of immense value to the human race. They are destined and calculated to answer most important moral and religious purposes.

Mén, with their present nature, under a constant course of prosperity, would degenerate into devils or brutes. Uninterrupted ease and quiet contract the heart and steel it against emotions of sensibility—the man rushes into vices and crimes, or sinks into sloth. So often have I seen the hearts of men depraved and their moral character debased, by sudden prosperity, that I am persuaded the world, without frequent inflictions of pain and distress, would not be habitable. The natural evils that surround us, intermingled with innumerable blessings, preserve the mind in perpetual vigor, in seeking the means of protection; they lay the foundation for the exercise of the finest feelings of the human heart, *compassion and benevolence*, which are the sources of social virtue; they humble the pride and arrogance of man, by creating in his mind a perpetual dependance on divine power; in short, they create and preserve that sense of obligation and accountability to God which is the germ of piety, and moral excellence.



## ADDENDA.

*Of the Lunar Influence.*

**I**T is a well known fact that the moon has a great influence on the elements of this globe, the effects of which are very visible in the vicissitudes of weather. This influence is supposed to be the principal regulator of the tides, and the efficient cause of the changes in the atmosphere, which produce rain, hail, snow and wind. It is believed also to affect the growth of plants, and Pliny, followed by St. Pierre, alleges that the lunar rays dissolve snow and ice. Popular opinion considers the moon as exerting a powerful influence on animal substances, and it is an incontrovertible fact that its beams accelerate the putrefaction of flesh and fish. Fishermen and sailors can all attest this fact, and it coincides with what Pliny asserts. Nat. Hist. lib. 2. 101. "Id manifestum esse, quod ferarum occisa corpora in tabem viso suo resolvat."\* Moon light dissolves or corrupts the flesh of animals that are killed; it renders sound fish soft in a few hours, and fishermen are careful to cover from its rays the fish they have caught. It probably acts upon flesh by stimulus, exciting a fermentation in the juices.

The Newtonian theory of tides, which explains the phenomena by lunar attraction, has been recently called in question and warmly opposed by the ingenious St. Pierre, in his studies of nature, who substitutes a scheme of his own, which ascribes the tides to the diurnal effusions of the polar ices. I am charmed with the writings of St. Pierre, which have opened a

\* St. Pierre affirms that the moon melts ice, and relies on the passage of Pliny in the chapter cited, "glaciem refundat"—but it is questionable whether the passage will bear that construction; and if it will, the assertion of Pliny is not supported by modern observations. See *Studies of Nature*, Vol. 1. Expl. of the plates, p. 69. Ice is diminished by evaporation in moon light, without forming water.

new and entertaining volume of the works of nature. But his theory of tides seems to manifest none of that ingenuity, which is conspicuous in other parts of his writings, and is utterly unsatisfactory.

In the first place, during six months or more, in each polar region, no snow or ice is melted, unless by the moon. The sun is below the horizon, and the moon's influence, if it dissolves snow and ice according to Pliny, evaporates all the water produced. This is a fact that accords with modern experiments, that ice in the night, however cold, loses a part of its weight, but it is by insensible evaporation.

To remove this difficulty, St. Pierre supposes the tides in one polar region to be the effect of the melting of snow and ice, in the opposite polar regions. But to this hypothesis we may oppose an insuperable objection, derived from the great and universal laws of equilibrium, observed by water. A diurnal wave or elevation would inevitably subside into a level, before it could reach the equator, or even the temperate latitudes. Besides the Atlantic is of very various breadth, in different latitudes. Between the coast of Brazil and Terra Firma on one side and Africa on the other, the breadth is scarcely half as great, as in the latitude of 25 deg. north. A diurnal wave compressed and dilated, in these different situations, must exhibit the tides in one place, twice as high as in another; but in the regions mentioned, this is not the fact.

There are many of the phenomena of the tides which cannot be explained on St. Pierre's hypothesis; but the foregoing remarks are sufficient for my present purpose. The tides doubtless depend on lunar and solar influence; but the phenomena cannot be solved on the common theory of *attraction*. In this respect, I am confident the Newtonian theory, as explained by Kepler and others is as inadequate, as that of St. Pierre. The latter author has enumerated some insuperable objections to that theory, to which the reader is referred. But I have other observations to make on this subject, which are probably new.

The manner in which astronomers have attempted to explain the opposite tides, is as follows. "The power of gravity diminishes as the square of the distance increases—therefore the waters

on the side of the earth next to the moon, are more attracted than the central parts of the earth; and the central parts are more attracted by the moon than the waters on the opposite side of the earth—therefore the distance between the earth's center and the waters on its surface, under and opposite to the moon, will be increased. The earth by its gravity falls towards the moon—the water directly below the moon rises and swells towards her—the water on the opposite side recedes from the center and rises—or strictly speaking, the center recedes from the water. On the sides of the earth between the points under and opposite to the moon, the water is depressed and falls below the former level.”

See Fergusons's *Astronomy*, on the Tides, and *Encyclopedia*, Art. *Astronomy*, 363.

As I am not about engaging in astronomical or mathematical calculations, I shall content myself with stating these general principles of Newton, Kepler, and later astronomers, with a few objections.

I. This theory does not explain, in a satisfactory manner, the reason why there are no tides in lakes and Mediterranean seas.

If the principle is just, that the earth recedes from the water opposite to the moon, leaving the surface of it at a greater distance from the center, why, when the Euxine or Mediterranean is opposite to the moon, does not the earth beneath these seas, recede from *their* waters, as well as from the waters of the ocean, in the same longitude? The earth consists of solid substances, and by the laws of attraction, must, in all its parts, be moved equally, under the same circumstances of distance from the attracting body and density, or solid contents. To suppose the earth, when covered by an ocean, to be attracted by the moon, and not when covered by a lake or arm of the ocean, is, in my view, neither logic nor philosophy.

Nor is the reason assigned for the defect of tides in lakes and seas, on the side next to the moon, in the least satisfactory. It is found in the *Encyclopedia* in these words. “There are no tides in lakes because they are generally so small, that when the moon is vertical she attracts every part of them alike, and therefore by rendering all the water equally light, no part of it can be raised higher than another.”

But this explanation does not meet the difficulty. The Newtonian theory stands on the hypothesis that the waters on the side of the earth next to the moon, are more strongly attracted than the adjacent land; therefore they rise above several feet of the earth. But the solution above recited does not reach this point; for the waters of the ocean rise *higher* than the contiguous earth; but the waters of lakes always observe the same relative altitude on their shores. If then the moon attracts the waters of lakes at all, or occasions them to rise, it attracts the adjoining earth and raises it in the same degree as the waters; but in regard to the ocean, it attracts the water and leaves the contiguous earth behind. In short, if attraction and gravity have uniform laws, as we must believe they have, the attraction of the moon will not account for tides in the ocean, while there are none in lakes and inland seas.

II. If the moon's attraction is the cause of tides, why is its force much less in the equatorial regions, than in the distant parts of the globe? It is a well known fact, that the tides within the tropics are very small, and that they are more considerable as we recede from the equator towards the poles. This is contrary to what ought to be the case, on the principles of attraction; for on the Newtonian theory of gravity, the highest tides should be on the parts of the earth nearest to the moon. The reverse of this is the case, and the circumpolar regions of the earth have the highest tides. The tides within the tropics are from 12 to 24 inches—in the latitude of Greenland, almost as many feet.

III. The theory of Newton is not reconcileable with his own principles of gravity, which suppose the force of it to be equal to the quantity of matter contained in bodies. Now the theory implies that on the side of the earth next to the moon, the water is attracted *more* than the earth; but on the opposite side, *less*. This cannot be solved on the principle of *distance*; for this is too small to account for a hundredth part of the effect. Indeed the water and the land on the shore, may be considered as at the same distance.

Nor can it be solved on the principle of a difference in the quantity of matter, in earth and water. If the earth, having



more density and matter, is most attracted, the principle must act uniformly on both sides of the earth—on both sides, the earth must move towards the moon further than the water, which is contrary to fact.

If the water has most matter, the same principle must govern it on both sides of the earth, and move it farthest towards the moon.

But here the principles of cohesion interfere with all these deductions. These principles are so powerful, as to overcome the attraction of a distant body, nor is it to be supposed that the power of the moon overcomes the force of cohesion, and by attracting the parts of the earth next to it more than the parts on the opposite side, changes the form of the earth from a sphere to a spheroid. It is not supposed that the whole solid mass of the earth is continually changing its figure by means of lunar attraction. If so, this figure must be rotatory.

The theory then supposes that on the side next to the moon, the water is most strongly attracted and rises above the earth—but on the side opposite, it is attracted less than the earth. The solid globe is moved towards the moon, and the water left lagging behind! What is more singular, the earth near the equator, on the side opposite, is drawn only two feet further towards the moon than the water, or perhaps but one foot; while in the temperate latitudes, it is drawn six or eight feet, and in the latitudes of 60 and 70 degrees, fifteen, eighteen, and twenty-five feet further than the water. This may be philosophy, but to me it is utterly unintelligible!

Nothing is a more serious misfortune to science, than the errors of a great man. Most of mankind take principles and facts upon trust, and defend them with a zeal proportioned to their confidence in the man who has published them. I revere the character of Newton, of Kepler and of Haller; but this veneration does not in the least incline me to receive their doctrines without being convinced that they are well founded. After most careful investigation, I am satisfied, that the principles of attraction, will not account for the tides opposite to the moon, nor for the difference between the height of the tides in differ-

ent latitudes. Yet I have not the least doubt, that most of the phenomena of tides are regulated by the moon.

If I was asked, on what principles the tides depend, my answer would be, *I do not know*. But numerous facts, all concurring to the same point, lead me to *suspect* the vibrations of the ocean to depend on electricity, influenced by the moon, the sun, or other distant orbs, and acting by repulsion as well as attraction; or by increasing and diminishing the elasticity of the water.

In the first place, it is agreed among philosophers, that the air, when free from vapor, is an electric; that when cold, it is most electric, and when heated, it becomes a conductor; and consequently that the atmosphere in the torrid zone is always in a conducting state, while the air of the northern regions, if clear, is an electric. In short, it is agreed that the atmosphere of the temperate and frigid zones contains more electricity, than that of the torrid zone.

These facts correspond with the phenomena of tides. In the regions, where there is the least electricity, there is the least intumescence of the ocean—those are the equatorial regions. There, the temperature of the air also sustains very small variations; so does the height of the ocean. As we recede from the equator cold and electricity increase; so does the elevation of the tides.

Again, the same train of phenomena attend the barometer. Within the tropics, the variations of the mercury in this instrument, are very small; but in the temperate and cold regions, they are more considerable, and increase as we recede from a warm to a cold and electric atmosphere.

Similar phenomena attend the twilight. Within the tropics, the twilight is of much less duration, than in cold regions. "Heat, say philosophers, diminishes the air's refractive power and density, and cold increases both. The horizontal refractions are near one third less at the equator, than at Paris."

Ferguson's Astron. 97.

The density of the atmosphere, within the tropics, may be less than at the polar circle; but the weight is nearly the same, the barometer being in general as high at the equator, as in north-

ern latitudes. But the air, in hot climates, has less powers of refraction; that is, there is more power of refraction in an atmosphere that is most perfectly electric, or that contains most electricity.

It is remarkable also that, in equatorial climates, the atmosphere exhibits no visible streams of electricity; as it does in the polar circles.

I know not how far this parallel may be extended; but there is a surprising resemblance between all these phenomena. In general then we observe that in the equatorial regions, the density, weight, elasticity and temperature of the atmosphere, are more nearly uniform, than in northern climates; and the elevation of the ocean in tides corresponds with this uniformity. As we recede from the equator, the variations of the atmosphere increase, and so do the variations in the height and depression of the water.

From these phenomena a suspicion arises, that the medium by which the moon and sun act upon the ocean, is the electrical fluid; as their influence appears to be in proportion to the electricity of the atmosphere. Hence the highest tides at a distance from the equator, where the heat and cold and elasticity of the air are subject to great variations.

By what law, it will be asked, is this effect produced? I readily confess my ignorance. But the phenomena of opposite tides seem to bear a great affinity to the well known laws of electricity, *attraction* and *repulsion*, and a *positive* and *negative* state. I pretend not to account for the phenomena, for I am persuaded that the experiments on electricity which man is capable of making, will never unfold *all* its properties, nor explain *all* the laws by which this energy of nature is exerted in the government of the material system.

But the influence of the planets on the elements of this globe has, in all ages, been a subject of belief or of derision; and surely it is a subject in physics much more interesting to man, than many speculative questions which cannot affect his health and happiness, but which occupy the labors of investigating minds. I will therefore throw together a few observations

which may afford light on the subject; or at least may excite a spirit of enquiry.

In the first place, it is generally known and admitted that the influence of the sun and moon upon this globe are in proportion to their proximity. The highest tides are when the moon is in her perigee, and in conjunction with the sun, and especially when the earth is in her perihelion, or nearest to the sun. But the moon exerts more than usual influence on the atmosphere, in other positions. Her power is greatest in her perigee and apogee, and in her conjunction and opposition to the sun. Her influence on the tides, under the combined and separate operations of these circumstances, has been fully illustrated. But her influence on vegetation; on the vicissitudes of weather, on health, and the phenomena of the electrical fluid in earthquakes and volcanic eruptions, seems to have passed unobserved, or at least, to have never been reduced to any thing like system.

One of the most striking effects of lunar influence, is observable in earthquakes; which usually happen near the time of the moon's perigee or apogee, conjunction or opposition. As this fact seems to have escaped observation, I will here insert proof of it.

The great earthquake which demolished Lima on the 28th day of October 1746, happened six hours before the full moon, and the day before her apogee.

That which destroyed Lisbon Nov. 1, 1755, was three days before the change and four before her perigee.

The great shock in America on the 18th of the same month was a few hours after the full moon, on the day of her apogee.

The great earthquake in America on the 2d of June O. S. 1638 was on the day after the new moon and near her perigee. [Some accounts place this on the first of the month, in which case it was the same day with the change.]

The shock which convulsed America, and demolished mountains in Canada January 26th O. S. 1663, was on the day preceding the new moon.

The great earthquake in South-America, June 3d O. S. 1744 was four days after the new moon.



The memorable earthquake in North-America on the 29th of October O. S. 1727, was about three days before the new moon, but on the day of her perigee.

The shock in America on the 29th of November 1783, was on the day after the moon's perigee.

That on the 16th of May 1791, was on the day of her perigee and one day before the full moon.

The shock on the 1st of November 1761, was the day before her apogee.

The great earthquake in Iceland on the 10th of July 1789, was on the day of her apogee, and three days after the full.

That in Tuscany on the 30th of September in the same year, was two days before her apogee, approaching the full.

A shock at Lisbon on the 27th of November 1791, was two days after her perigee and change.

A shock on the 15th of January 1791 in Virginia, was two days after her apogee, and approaching the full.\*

These two last instances, according to another almanac, happened *one* day after the perigee and apogee. I have not taken pains to enter into *exact* calculations of the moon's place, as I do not deem it material. It is sufficient for my purpose that *almost all* earthquakes happen near the time of the moon's conjunction and opposition, or her perigee and apogee. Of these positions, it is obvious that her perigee and apogee have much the most influence; and the instances I have examined are almost equally divided between these two positions. Of all the earthquakes which I have compared with the moon's place, one or two only fall in her quadratures, and at her mean distance from the earth.

An instance happened on the 11th of April 1799 in Carolina. I have compared several other instances, which happened near the perigee and apogee, but it is unnecessary to specify them. The examples mentioned will establish the generality of the fact, and the soundness of the principle.

On the principles of *attraction*, it will readily be admitted that the proximity of the moon to the earth, at certain periods of her

\* A severe earthquake in the west and north of France on the 25th of January of the present year, 1799, was a few hours after the moon's perigee.

revolution, must *draw*, or excite into action and discharge, the electricity, of the earth. This accounts for earthquakes during the moon's perigee. But on enquiry we find a great proportion of the shocks take place during her apogee, when her distance is greatest and her supposed power the least; and not only so, but during her opposition to the sun, when her *diminished* influence is supposed to be counteracted and still *further diminished* by the attraction of the sun. This is an important fact and deserves investigation. That the influence of the moon is the direct exciting cause of earthquakes, can hardly be questioned, after establishing the fact, that four out of five, or a much larger proportion, happen when she is in particular parts of her orbit; but why her greatest distance and her least, should produce exactly the same effects, a fact equally well established, is a question which can perhaps be solved only on electrical principles.

That the electricity of the atmosphere and earth, is the medium by which the moon acts upon the elements of the globe, is rendered probable by another fact. I possess the exact dates of very few volcanic eruptions; but by comparing such as I have, with the moon's place in her orbit, I find these eruptions begin or suffer violent exacerbations, at the time the moon is in her perigee or apogee; or in her conjunction or opposition.

The great eruption of Vesuvius in 1779 was augmented on the 8th and 9th of August, when the moon was in her perigee.

The tremendous eruption of Heckla in 1783, began on the first of June, when the moon was in her apogee, and increased till the 8th, after which it continued to be violent for a long time.

An eruption of Vesuvius on the 10th of May 1784 was during the moon's perigee.

An eruption of fire near Palermo in Sicily on the 13th of March 1785 was two days after her perigee.

An eruption of Etna on the 19th of May 1780, the dark day in America, was the day after the full moon.

A dark day on the 9th of August 1732 was about the time of the new moon, and her apogee. The dark day at Detroit October 16, 1762 was the day after her perigee, and one day before the change.

The eruption of Vesuvius March 8th, 1730 was on the day after the new moon, and a great exacerbation happened on the 14th, the day before her apogee.

The great eruption of the same volcano in 1794 was announced on the night of the 12th of June, nine hours before the full moon, by a violent earthquake. The eruption took place on the 15th.

The darkness in Canada, on the 15th and 16th of October 1785 was on the days next preceding the full moon and her perigee. The obscurity on the 9th of that month was near the quadrature.

The eruption of Heckla in 1766 began on the 15th of April, the day before the moon's apogee.

The great eruption of Vesuvius and the earthquake, which buried Herculaneum, on the 1st of November A. D. 79, were the second day after her perigee.

The influence of the moon in producing storms of rain, snow and wind, is universally admitted; and that these happen near the positions of the moon already described, no man will undertake to deny. The West-Indians expect hurricanes only near the time of the full and new moon; or her perigee and apogee. This is further evidence that the electrical fluid is the instrument of these commotions in the atmosphere. Electricity is known to be the cause of winds, and its agency is visible in producing hurricanes; for experienced seamen foretel a hurricane by the unusual transparency of the water. Now it is a well known fact that electricity possesses the singular property of giving transparency to opaque bodies.

A little before a hurricane in the West-Indies, seamen can see the lead, at an unusual depth; the sea also swells and rolls upon the shore in a singular manner, tho the air is perfectly tranquil. An effervescence also or bubbling is observed in the water. Dark clouds are formed, and the atmosphere, before the tempest, is observed by vapors sensibly mephitic. See a letter from Gov. Ellis, dated March 6, 1789, in the 9th vol. of Museum, 215. Hence we observe the correctness of the common saying among seamen, that "hurricanes come out of the

sea." They are evidently generated by extraordinary discharges of electricity. Hence they are most frequent in the windward islands, which are all volcanic; some of them still discharging fire and smoke at times, and all of them evidently resting on a volcanic base.

Further, that electricity is the great agent in these agitations of the elements is rendered probable by the coincidences in time, between the more violent hurricanes, and great volcanic discharges from Etna, Vesuvius and Iceland. Witness the terrible hurricanes of 1747, 1766, 1772, 1780, 1784 and 5, all of which happened near the time of great eruptions from the volcanoes mentioned; all of which are distinguished in the annals of the Antilles, and still recollected with horror by the inhabitants. And this circumstance is no inconsiderable evidence, that the agent in volcanic eruptions, as well as in hurricanes, is electricity, and that this element is often disturbed or ejected from the whole globe, nearly at the same time.

Most of the great tempests, in all latitudes, happen near the moon's perigee and apogee; and in these positions, we observe essential changes in the temperature of the atmosphere. I have taken some pains to compare the changes in heat and cold, with these positions of the moon, with a view to learn, whether the effects are uniform. On examining the state of the thermometer for two years, I find that, in almost every instance of the moon's perigee and apogee, especially in winter, there was a considerable change of temperature. Usually the weather grew colder, as the moon approached her perigee. But the effects were not uniform; sometimes the weather became more temperate, at the perigee. But one general remark will be found true; that in regard to heat and cold, the moon's apogee and perigee produce, at different times, precisely the same effects. This remark accords with what has before been observed in regard to earthquakes.

It is a general remark that the weather becomes cooler as the moon approaches the change. Should this remark prove to be well founded, the result would be this principle, that the cold is increased, or rather the heat lessened, by the combined influence



of the sun and moon. This principle would accord with another observation just made, that the weather is cooler, during the moon's perigee, which is generally true in winter. That is, the greater power is exerted by distant orbs on our atmosphere, the more the heat is diminished. But this observation is not universally true. It is true that our winter occurs during the earth's perihelion; but this is usually explained on the principle of the obliquity of the sun's rays—a solution that perhaps is not completely satisfactory, altho, to a certain degree, it is doubtless just.

It is a popular opinion that vegetation is less rapid, and the flesh of animals less firm and substantial, and new-shooting plants less vigorous, during the wane of the moon, than during her increment. This opinion is too general and too respectable, to be considered the fruit of ignorance and credulity.

Aristotle alleges that the close of the lunar month is cooler than the other parts of it; and that during the decrease of the moon, the bodies of living animals possess less heat than at other times. *De gener. animal. lib. 2. 4.* These remarks, whether true or not, coincide with the modern popular opinion just recited.

We are apt to neglect the opinions and practices of barbarous nations, and to hold in contempt the knowledge of ancient nations. This often happens, I suspect, because we are less wise, than those whom we affect to despise. Cesar in his first book of the Gallic war, chapter 40, relates, that the ancient Germans, who were great observers of the phases of the moon, declined engaging in battle, during the wane of that planet. He had offered battle to Ariovistus, but this commander declined a general action, and permitted only skirmishes. Cesar enquired of his prisoners the reason of this conduct, and was told that it was customary with the Germans to consult their venerable matrons, who, by means of lots and divination, pronounced on the propriety of giving battle; and these had declared that it was not possible for the Germans to conquer, if they engaged in action before the new moon. "*Non esse fas Germanos superare, si ante novam lunam praelio contendissent.*" See Cesar's Com-

mentaries, in the passage cited, and Henry's History of Britain, vol. I. ch. 4.

We have this custom of the Germans presented to us, disguised with superstition ; but I strongly suspect it had its origin in the observation of the fact, mentioned by Aristotle, that in the decrease of the moon, animal bodies have less heat and vigor.

I am the more inclined to believe this, because the doctrine accords with modern observations concerning the invasion of fevers, and especially of epidemic diseases. Many medical authors concur in the fact, that diseases more generally attack the human body on the second or third day before the new or full moon. On examining the accounts of several writers, I find the times of invasion to be two or three days before or after the new and full moon, or about the time of its conjunction with the sun. See Jackson, Grainger, Lind and many other authors.

Diemerbroeck is explicit on this point. He relates that in the plague of 1636, "two or three days before and after the new and full moon, the disease was more violent ; more persons were seized at those times, than at others ; and those who were then seized, almost all died, in a very short time. Many patients who appeared before to be slightly affected, *nescio qua virium labefactione oppressi*, says the author, by an unaccountable decline of strength, sunk and died in a few hours."

De peste, page 9.

From the observations of physicians it then appears, that this debility of the animal powers takes place near the time of the conjunction and opposition of the sun and moon ; near the moon's perigee and apogee ; and in the same positions in which earthquakes and storms more generally occur.

Of the reality of this effect of the elements on the body, there can be no rational doubts. About the time of the change of the atmosphere, which indicates an approaching rain or storm, persons of debilitated habits of body, perceive the change, by a loss of vivacity, dulness or heaviness ; parts of the body that have lost their natural energy by means of wounds and tumors experience painful or uneasy sensations, by which storms are often predicted.

Fowls perceive this change in the atmosphere, and manifest their sensations. Candles sparkle and snap; the tallow melts more freely, and the flame is less steady. These things were observed by Aristotle and Pliny.

This change in the atmosphere is not only perceptible by the sense of feeling, but becomes visible. Distant objects seen over water, and some writers say, over land also, *loom*, that is, rise, or appear elevated, several degrees, above their usual altitude. The ear also will aid us in foretelling rain and wind; for sounds become audible at an unusual distance.

Persons in full health are not sensible of these changes in the elements; at least, they are not so much affected, as to observe them. But from many years observation, I am convinced, that the catarrhal affections, which pass under the popular name of *colds*, are occasioned by the alterations in the atmosphere which precede changes of weather, and few of them from the application of cold. I know this to be the case with myself; those phases of the moon, which have been mentioned as producing great effects on the earth and atmosphere, rarely pass, without affecting me with slight catarrh. This has been remarkably the case, since the fever of 1798, which left me in a state of debility. But many persons can attest the truth of the principle; nothing being more common than for persons to remark, that they cannot tell how they took cold; and it being well known that catarrhs are more general and severe, on the transitions from cold to heat, than from heat to cold. The obstruction of the glands is evidently the effect of an insensible change in the atmosphere, probably by means of the decomposition of the electricity and the vapor or other elementary substances of the atmosphere. And the winds to which we ascribe the changes of weather are unquestionably an *effect*, rather than a *cause* of those changes.

These alterations in the atmosphere appear to have some connection with the tides; or rather with the cause of tides. It is said by seamen and other observers of the seasons, that full tides are apt to produce rain; that rain which begins at high water will cease, with the recess of the tide; but rain beginning at low water, will be of considerable duration. These and other obser-

variations, if just, manifest an influence of the tides over the state of the atmosphere, or a dependence of both on one common cause—the same invisible energy of electricity producing both effects.

It is a known fact that the flowing tide often brings with it a breeze of wind. This is ascribed to the friction of the water on the air, and the cause assigned may be sufficient to account for the phenomenon. But it may be suggested whether the electricity of the atmosphere, may not produce both the tide and the wind. The intumescence of the ocean, previous to earthquakes and hurricanes, which are evidently occasioned by electricity, seems to bear a great analogy to the tides and to authorize my suspicions. The swell of the ocean during earthquakes, has usually been ascribed to the raising of the land beneath it; but this cannot be the cause, for such a swelling of the land never takes place over whole continents. The swell of the water is probably the effect of the elastic powers of the electricity discharged, operating on the water itself.

There are many diurnal and periodical phenomena, which are evidently connected with the lunar and solar influence, and deserve to be mentioned in this place.

It is a well ascertained fact, that in the tropics, where the weight of the atmosphere is subject to very small variations, the barometer uniformly rises and falls with the tides, about two thirds of a line. *Encyclop. art. wind.* This is a small variation. But,

It is also asserted that, in those regions, “the variations in the gravity of the atmosphere seem to depend on the heat of the sun, as the barometer constantly sinks near *half an inch* every day, and rises again to its former station in the night.” *Encyclop. art. atmosphere.* [I suspect the words “half an inch” to be an error.]

Now, if the barometer depends, for its fluctuations, on heat, we should suppose the same cause would operate in northern latitudes, and occasion a diurnal rise and fall, in an exact ratio to heat and cold. In this case, a barometer would be a thermometer.



eter reversed; rising with augmented cold and sinking with an increase of heat. But this is not the fact. The barometer often rises with the increase of heat, between sun-rise and twelve o'clock. Heat therefore cannot be the direct cause of the diurnal depression of the barometer in the equatorial climates; unless it has different laws, in different latitudes, which philosophy will not admin.

Let us compare the facts stated with the known phenomenon of the different forces of water, during the day and the night. The water-wheel of any mill, the altitude of the water and the resistance being precisely the same, makes more revolutions, in a minute, during the night, than in the day time. I have long been acquainted with the fact, and it is known to every miller; but as I have never seen a statement of it in any philosophical work, I have had the curiosity to make an accurate experiment to ascertain the difference. This was done on the night after the 28th of May 1799; the weather being perfectly serene, the air free from vapor, not a breath of wind stirring to ruffle the water, and the barometer, on the evening preceding, at half past eight, standing at 30 and one tenth. The first observation was made at a quarter before 7 P. M. sometime before sun set, the thermometer standing at 65 deg. when the wheel of the mill made exactly 16 revolutions in a minute. The altitude of the water was marked with precision; but the delivery of the water not having been exactly adjusted to the current entering the pond, the water rose, and at 9 o'clock had half an inch of altitude beyond the mark. By this means, my observation at that hour was lost. By raising another gate, the water was reduced to its former altitude, and by twelve o'clock the discharge of the water was exactly equal to the current, and from that time to sunrise, the altitude continued the same. At twelve o'clock and from that hour to three, the wheel made  $17\frac{1}{2}$  revolutions in a minute; the observations being often repeated, without a sensible variation of results. Soon after three o'clock, a small acceleration was perceptible, but it did not amount to half a revolution, until about half past three, when

the wheel made 18 revolutions in a minute, which accelerated movement continued till half past four, when, being near sun rise, the observations were discontinued. During the last observations, I perceived a very small retardation of movement, but it did not amount to half a revolution. To prevent any difference of resistance in the mill, not the slightest alteration was made in the elevation of the stone, or the quantity of wheat delivered from the hopper, from the beginning to the end of the observations.

I had not a barometer with me at the mill, but about eight o'clock, on the following day, the barometer stood about one twentieth of an inch higher, than on the preceding evening. The thermometer fell, during the night, to 54 deg.

From this experiment, it is obvious that the weight of the atmosphere could not be the sole cause of the acceleration of the wheel. The acceleration at twelve o'clock was almost an *eleventh*—at a later hour, a *ninth* of the whole movement. The increased gravity of the atmosphere will not account for a tenth of the difference.

We must then resort to other principles for a solution of the phenomenon. It is commonly supposed that water is a non-compressible substance; but this opinion has been justly questioned. However this may be, I have little hesitation in resolving the phenomenon of the water-wheel into its increased elasticity during the night. How or why the subduction of light and heat should produce or increase this property in water, I leave for electricians to determine. The effect cannot be ascribed to the increased gravity of water, during the night, for no such increase is observed.

It is an observation of seamen that ships make more way in the water, by night than by day, with the same force of wind. I should suspect that the moisture on the sails might, in a degree, contribute to this effect; but it must be recollected that in rainy days there is no difference in the moisture of the air by night and by day. Can the effect then be ascribed to the cause that accelerates the movement of water-wheels by night—an increased elasticity? If the gravity and density of water were augmented during the night, these would render the water more

buoyant, but retard the motion of a ship, by increasing the resistance. We are therefore driven to the same hypothesis, an increase of elasticity, which renders water more buoyant when at rest, and more impressible when in motion, without an augmented density and weight. But I am not sure that the moisture of the air will not account for the whole effect.

If the elastic power of water is increased by the abstraction of heat, does it not follow that this power must be greater as we recede from the equator; and of course, any given force applied to the water in different latitudes, will occasion a vibration of that fluid, proportioned to its elasticity. Hence the small tides within the tropics, where the heat is nearly uniform; and the high tides in the northern regions, where the vibrations in the temperature of the atmosphere, are more considerable. Yet facts do not permit us to ascribe this elasticity to cold. It is more probably owing to the quantity of electricity, or to its peculiar combination with aerial substances, of which cold is the effect. Perhaps the following observations will throw some light on this subject. Aristotle and after him, Pliny asserted that no animal dies, except during the ebb tide. "Nullum animal nisi aestu recedente expirare. Observatum id multum in Gallico Oceano, et duntaxat in homine compertum." Pliny, Nat. Hist. lib. 2. 98. "No animal dies, except during the recess of the tide. This is particularly observed on the coast of Gaul; and is at least true with respect to man."

The first part of this observation is probably too general; but modern facts confirm the assertion, within certain limitations. A late minister at Barrie in Scotland, contiguous to the German sea, made a similar remark, after fifty years observation.

Sinclair, vol. 4. 240.

The reason why Pliny has specified the coast of France, as remarkable for the fact stated, is very obvious. France lies on the main ocean, and the time of high and low water is the true time. On the coast of Italy, where there are no tides, the observation could not be made; and if made by the time of ebb tide in rivers and bays, it would not be just.

Another remark made by physicians, is, that *ceteris paribus*,

more persons die during the latter part of the night, than at any other time in the solar day. This remark has not come to me from a sufficient number of observations to command full belief; but it accords with a few observations of my own. If universally true, it would contradict in part the remark of Aristotle and Pliny; but it is possible, both remarks may be true with certain limitations. The fact may be more obvious, when ebb tide happens between midnight and sunrise; and less so, when flood tide happens at that period; that is, under the combined or separate operation of the two causes.

Other facts lend their aid to support the observation that some essential change in the properties of the atmosphere takes place, in the latter part of the night. This is the time when all fevers remit or intermit. The exacerbations and paroxysms of fever invade the patient, during some part of the day, and subside in the latter part of the following night.

Again. The chills that precede fevers usually come on in the same part of the day, that is, between midnight and sunrise. This is remarkably the case with epidemic diseases, as all physicians agree. The fact has been ascribed to the debility induced by sleep; but I suspect it is owing to the debility induced by the same change in the stimulant powers of the atmosphere, which occasions the other phenomena before mentioned.

It is observable also that sleep, in the latter part of the night, is more sound, than at other times; an effect perhaps of the same cause.

Lind observes that in the East-Indies, patients generally expire at low water—the same fact is observable at the full moon—and convalescents usually relapse at these periods. See his Treatise on the diseases of hot climates. p. 86.

From experience I can testify that relapses usually occur, at those periods of the lunar month, when changes of weather take place.

Ulloa was careful to note the time of the tide when earthquakes occurred in South-America, and he found them invariably to happen at half ebb or half flood—never at high or low water.

Voyage, vol. 2. B. 7. Ch. 7.



There are other periodical changes in the atmosphere which deserve notice. Great storms of wind, snow and rain, usually begin, abate and cease at certain hours, viz. at six, nine, twelve and three o'clock; especially at six and twelve. To this remark there are very few exceptions.

Experienced accoucheurs inform me that in lingering cases of child-bed illness, paroxysms of pains recur at the same hours.

What is still more extraordinary, we are assured by unquestionable authority, that in volcanic eruptions, the discharges are more violent at these hours, than during the rest of the day. Sir William Hamilton, in his excellent account of the great eruption of Vesuvius, in June 1794, has the following passage. "The fever of the mountain, as had been remarked in former eruptions, showed itself to be, in some measure, periodical, and was generally most violent, at the break of day, at noon and at midnight."

Univ. Magazine for August, 1795.

These are the hours when we observe great changes in the atmosphere, and sudden effects on the human body in diseases. The break of day is precisely the time when the water-wheel is most accelerated—when fevers remit or intermit, and when the patient, lingering under disease, suddenly yields, and sinks into his grave.

To what cause shall these effects be ascribed? Not to lunar or solar attraction, in the usual sense of the word. Attraction is considered as a steady principle operating uniformly under the same circumstances; and therefore the attraction of the moon, whose position in regard to the earth is every day changed, cannot account for periodical phenomena, at certain hours in the day. The influence of the sun will better solve the phenomena; but how can the same principle, attraction, operating by uniform laws, produce the same effects at two opposite hours, for instance at noon and at midnight, which certainly is the case in regard to the exacerbations of volcanic eruptions, as well as in regard to the commencement, abatement, and termination of storms?

I do not know that any principle yet discovered will solve the difficulty. But the phenomena bear a greater analogy to the operations of electricity, than to any other principle in nature hith-

erto discovered. It seems necessary to invite to our aid repulsion as well as attraction, producing in opposite points, the same effects. The nature and operations of electricity are little understood, and probably will never be brought wholly within human comprehension.

It is to be wished that experiments on the revolutions of water-wheels, in different latitudes, may be made, with care and precision, to ascertain whether any acceleration at night takes place within the tropics, and if so, whether it equals the acceleration, in northern latitudes. And also whether the acceleration is greater in the latitude of 60 deg. than in the latitude of 40 deg. Our millers say that water has more force in winter, than in summer. This may be easily ascertained by experiment.

We are enveloped in a mass of fluids, whose combinations are in a continual process of change. The energy of action seems to depend on electricity—or the principle of light, heat and fire; but I am persuaded that the manner in which changes are produced, is very little understood.

I will close this lengthy article by observing that the phenomena of lunar and solar influence are so well understood and clearly proved, as to justify in our minds, the great attention which the ancients paid to the influence of the planets on this globe. If they went into one extreme, by ascribing too much to that influence, the moderns have erred, on the other extreme, by holding their doctrines in contempt.

The sun is the great source of light, and his rays excite the heat which exists in and around the globe. It moves this universal principle, which constitutes the energy of the material system, under the control of infinite intelligence.

The moon is placed in the vicinity of the earth, to give variety to the seasons, and by acting on the elementary principle of heat, she occasions the vicissitudes of rain, snow, fair, calm and tempestuous weather. The changes which precede and produce these vicissitudes appear to be variations in the combinations of heat or electricity, with the other elemental principles of the atmosphere. These modifications of the atmosphere, without any access of new matter or diminution of its mass, produce differ-

ences in its density and elasticity, with all their various effects on the animal and vegetable systems. Hence a mere modification or new combination of electricity, with vapor or other aerial substance, may increase or diminish its stimulus—during the day, it may excite fever in the human body; during the night, a subduction of excitement in the atmosphere, may induce debility, and favor the invasion of disease and the approach of death. These are mere hints and conjectures, intended to excite investigation.

With respect to the supposed influence of comets on the elements of this globe, I would remark, that on the principles here suggested, that influence is very clearly proved and may be easily understood. The facts stated demonstrate that the sun and moon exert great powers on the globe; and the fact that earthquakes mostly happen in certain positions of the moon, prove that the medium of her influence is the electric principle.

Now comets are known to be of various magnitudes. Some of them are as large as Venus; much larger than the moon; with highly electrified atmospheres; and sometimes approaching near to the earth. The comet of 1577 came within less than a million of miles distance.

Those comets which pass the system at an immense distance from the earth can have no great influence; but others approaching near, produce tremendous effects. Hence during their proximity to the earth, the number and violence of earthquakes and volcanic discharges; tempests, inundations from rains and extraordinary tides; and most sensible changes in the powers of animal and vegetable life. That such are the effects, is proved not only by the concurring opinions of all the ancient philosophers, who were accurate observers of nature, but by one uniform series of historical evidence, for more than two thousand years. On the principles of electricity, which is disturbed, attracted, repelled and modified in its combinations with other substances, by the approach of distant bodies, the solution of the phenomena is easy and philosophical.

*Of Electricity.*

SOME modern philosophers suppose that the earth contains vast quantities of fire, which is the source of the principal part of the heat on the earth, the cause of vegetation, of earthquakes and volcanic eruptions, and of hot springs.

See Buffon, and Darwin's Botanic Garden. Additional Notes, p. 145. New-York edition.

There are some reasons to believe that particular parts of the earth abound with fire, or masses of burning lava. This opinion is supported by the issuing of smoke from the craters of certain volcanoes, for years in succession, without any eruption of fire.

But the theory which ascribes earthquakes to steam or vapor, appears to be very unsatisfactory. How can steam be collected within the bowels of the earth, sufficient to shake a continent of 3000 leagues in extent? If a great quantity of water should by accident fall on a mass of burning lava, the effect would not be a general equable shake or concussion, over a whole quarter of the globe, which sometimes happens in earthquakes; but a violent shake at the place of contact, and a disrapture of the earth, by which the force of the steam would be suddenly discharged into the atmosphere. This however is not the fact. Almost all earthquakes in North-America are progressive; beginning in the interior of the country and proceeding towards the ocean, in a direction perpendicular to the line of shore, that is, from north-west to south-east. Perhaps we can find a satisfactory solution of this phenomenon, upon electrical principles; but no cause can be found in the known properties and effects of steam.

One of the arguments used to maintain the theory of steam, is derived from the known fact that springs and streams are usually exhausted by extreme drouth, some time antecedent to earthquakes and volcanic eruptions. But the fact, instead of supporting the theory, operates to destroy it.

The hypothesis supposes that, at certain times, the springs in the vicinity of burning lava descend and fall upon it; and the



water being raised into steam and extremely rarefied, expels the burning materials in volcanoes with great violence; and in earthquakes, the force of the steam alone ascends and shakes the earth.

But why should the water of the springs find passages to the lava, at some times and not at others? If the passages were always open, the water would always descend. If they are open at particular times only, there must be some subterraneous force exerted to open them, before the water comes in contact with the fire; the effect then or disrapture, must take place, in a certain degree, before the supposed cause can operate. Consequently the force exists anterior to the disrapture which brings the water in contact with the fire. This conclusion supercedes the use of vapor.

But by what magic does it happen that all the springs and rivers in the neighborhood of a volcano for instance, disappear about the same time? By what mutual consent, can this remarkable phenomenon be produced? And why, after the eruption, do all the springs and rivers resume their former channels? Is it possible to suppose thousands of passages, scattered over many leagues of earth, to be all opened at once, to convey subterranean springs to a particular place, a few months anterior to an eruption of fire; and after the eruption, to be all closed at once and the water compelled to run in its former channels? Yet all this must be admitted on the theory of steam.

That large volumes of water are sometimes thrown into the basons of volcanic mountains and ejected, is true; but, in such cases, the disrapture is occasioned by a previous earthquake, or force of fire, and the water is discharged in mass; not in the form of vapor.

It is a fact authorized by all history and observation, that great earthquakes and volcanic eruptions are often, if not usually, preceded by severe and universal drouth. This drouth often extends over whole continents; and I find that the defects of water which occasion the terrible famins in Egypt, India and China, of which we have many accounts, happen generally, (and I suspect always,) a few months before and during some

great discharges from volcanic mountains. I have certain evidence that this failure of rains and springs sometimes occurs ten months before the eruption. This was the fact in Bengal in 1769—and in America in 1762 and 1782. At other times, the drouth happens during the eruption, and in some cases, it is continued for two or three years, in which eruptions take place in different parts of the world.

The drouth, on such occasions, is not occasioned solely by a failure of rain, but by the concurring influence of excessive evaporation. This fact is capable of demonstration. Sir William Hamilton, Univ. Mag. Aug. 1795, in his account of the eruption of Vesuvius in 1794, informs us that some days previous to the discharge, the great fountain at Torre del Greco began to decrease, so that the corn-mill worked by it moved slowly. In the wells of the town, the water fell and it was necessary to lengthen the ropes daily. Some wells became quite dry. In a vineyard, near the town, some persons were alarmed, eight days before the eruption, by a sudden puff of smoke and explosion from the earth.

It is recorded that Pheycides foretold an earthquake in Greece, from a sudden failure of water in a well. These facts indicate unusual evaporation.

It is observable also that the exhaustion of water extends, in such cases, to a greater depth than usual. The earth, below the usual influence of the sun's heat and of rains, loses its natural moisture. Such probably was the case in 1782, when the cedar swamps in New Jersey took fire and burnt to the depth of many feet. And this is probably what Livy meant, when, in speaking of the terrible drouth in Rome, before the great eruption of Etna, B. C. 426, he uses the words "*ingenito humore egens*"—a failure of native moisture.

In the vicinity of volcanoes, this evaporation may be accounted for on the principle of subterranean heat, which is sensibly increased, some time before an eruption. But this solution cannot apply to countries a thousand leagues distant, which suffer extreme evaporation, at the same time.

There appears to be no way to account for the phenomenon

but by the great principle of action, electricity. Indeed the discovery of the fact, that most earthquakes happen under particular phases of the moon, and that volcanic eruptions are obviously affected by her position in her orbit, seems to place this point beyond question.

It seems then to be very certain that the electricity which exists in and about the earth is essentially influenced by the sun, moon and planets, but especially by the larger comets; which pass near the earth. The influence of these bodies, or the essential laws of the universe, disturb this fluid and vary its distributions and its combinations with other substances.

Previous to earthquakes, volcanic discharges and hurricanes, it is evident from many phenomena already enumerated, the electricity of the earth passes out of it in unusual quantities; and as the air is often a bad conductor, the fluid attaches to it and carries along, the water upon the surface and within the bowels of the earth. This process continued for some weeks and months, exhausts all the rivers and springs. The atmosphere, in the mean time, becomes more and more dry, and a worse conductor, until both air and earth become perfectly electric, or non-conductors. In this situation, either a great demand for the fluid in some distant region, or a great accumulation of it in the bowels of the earth, has prepared the way for a sudden explosion, but no conducting medium exists, sufficient to convey it. A fall of rain, at this time, may create that medium; and hence the common fact that earthquakes happen soon after rain, succeeding severe drouth. If no rain falls, the fluid accumulates, till it forces a passage through the great apertures, formed for the purpose, the volcanic mountains, setting fire, on its way, to the hydrogene, and other inflammable substances, which the ocean generates or deposits in their bosoms.

I know not that these conclusions are just, but the facts from which I reason, are indisputable. The uncommon discharges of electricity, *previous to these great concussions*, are indicated not only by the exhaustion of streams and springs but by many phenomena in the atmosphere, showing it to be highly electrified. Meteors, huge globes of fire, shoot through the air, not only af-

ter, but before the eruption. Witness the meteors of 1758, 1762, and one in May 1783, mentioned in the preceding history. And Sir William Hamilton informs us that the air was unusually charged with electricity, some days before the eruption of 1794.\* Unusual halos and mock suns, fiery and luminous appearances in the heavens, with extraordinary tempests, and hail, are evidences of the same fact.

The idea that the heat which we experience exists in and about the globe, is undoubtedly well founded. The sun is probably the great electric of the system, which excites into action the heat of the atmosphere and the earth; but there is no reason to believe that heat is principally derived from that body. The solar rays constitute a very small part of the heat of the earth; but they excite it by the rapidity of their motions, or by decomposing that which exists in the air and earth.

Hence there appears to be little foundation for the opinion, that the inferior planets which are nearest to the sun, have more heat, than Saturn and Jupiter. If heat is diminished in the ratio of the squares of the distances from the sun, it is on the principle that heat consists in solar rays; but this is a very questionable doctrine. Light is a substance, but does not necessarily contain heat; at least not any that is perceptible. It is probable, that if the solar rays falling on Saturn are diminished in number, according to the doctrine of diverging lines, that this defect is supplied by an increase of density or susceptibility of excitement, in the atmosphere of that planet. The density and capacity of being excited may be in a direct proportion to the solid contents of the planet, or in a duplicate ratio to

\* May not the appearances of certain epidemic diseases of inflammatory diathesis be ascribed to this too highly electrified, and of course, stimulant state of the atmosphere? The influenza of 1708 was preceded by a meteor or fiery globe. In 1758 was a meteor and the measles began in America. In 1771 a meteor, and then commenced influenza and measles. In 1775 a meteor, and the cynanche maligna prevailed. In 1783 two meteors, and then commenced measles and scarlatina anglicana. In 1788 a meteor, and immediately began the measles. If these coincidences are all the work of chance, they are certainly a very singular kind of accidents. More facts and observations than I possess are necessary to settle this question.

\* In America, and in Europe, influenza.



the distance. Hence the larger planets are placed at the greater distance. And on this principle there is no ground to calculate, as Newton has done, the extreme heat which comets acquire in their perihelion. No substance of which we have any knowledge, could sustain the intensity of heat which, he has calculated, the comet of 1680 must have received. It is more consonant to the general arrangement of the universe, as far as our limited understandings can comprehend it, to suppose none of the great orbs that roll in infinite space, are either over heated or over cooled. Every orb has probably its own fund of heat, and the capacity of being excited, suited to its place and destination. The planets, the comets in the parts of their trajectories most remote from the sun, and even the sun itself, may be inhabited.\*

\* I take this opportunity, in discussing the question concerning the origin of heat, to notice what philosophers have said on the subject of the internal heat of the earth. Darwin, in his *Botanic Garden*, note 6, alleges the earth below the depth of about ten feet, to be always of the same temperature, which is 48 deg. by Fahrenheit. He cites Dr. Franklin's observation, that spring water at Philadelphia is of 52 degrees, which, he supposes, a proof of internal heat from central fires. For as the climate of North-America is colder, than that of England, he could not account for the excess of heat in the water at Philadelphia, beyond that of England, but by presuming it to be occasioned by internal fires. Yet in another passage, in note 74 the author intimates that he had an idea of a difference of heat in different latitudes, derived from the action of the solar rays. Yet I cannot find any European author who appears to have had a correct idea of this subject; and Mr. Jefferson, in his *Notes on Virginia*, query 5, has manifested his ignorance of it, by a most egregious mistake. Speaking of a cave in Frederick county, he informs, that the thermometer, which stood at 50 deg. in the open air, rose to 57 deg. in the cave. He then adds the following remark, "The uniform temperature of the cellars of the Observatory of Paris, which are 90 feet deep, and of all *subterranean cavities* of any depth, where no chymical agents may be supposed to produce a factitious heat, has been found to be 10 deg. of Reaumur, equal to 54½ of Fahrenheit. The temperature of the cave above mentioned so nearly corresponds with this, that the difference may be ascribed to a difference of instruments."

It seems a little strange that so gross an error should have passed uncorrected, till this late age, on a point of fact so easy to be ascertained.

The truth is, the temperature of the earth, below the diurnal and annual influence of the solar rays, which may be perhaps ten feet in solid earth and 30 feet in open wells, is regulated by the proximity of place to the equator, subject to small variations, from the position of the place in regard to the ocean and the height of the land.

But what is remarkable, this temperature of the earth and water in the interior of the globe, is precisely the *mean temperature* of the climate, in the place where the observation is made. Thus, let the highest and lowest points be taken daily by any good instrument, and divide the

In a knowledge of mathematics and the application of mathematical principles to the material system, Newton is, and probably will forever be unrivalled. But modern philosophers enjoy the benefit of many discoveries made by experiments and by collections of facts, which give them an eminent advantage over the great astronomers of the last century. The ideas of Newton in regard to the tails of comets seem to have no just foundation, and to be utterly repugnant to his own principles of the powers of

sum of all the observations by the number of days in the year, the quotient will be the mean temperature of the climate, and precisely the temperature of the water, below the variations of heat and cold. If any difference should be found, it must be owing to inaccuracy in the observations. It is more usual to take three observations daily; at 2 o'clock P. M. the warmest time in the day, at sun-rise the coldest time, and at sun-set, which is found to be the mean temperature. By observations made in the city of New-York for one year, I found the mean temperature to be 53 $\frac{1}{2}$ ; but this is  $\frac{1}{2}$  degree too high; owing to an excess of heat within the city, beyond the general temperature of the climate. The air in a city cools less at night, than in the country, and hence the morning observations were found to be too high. In many instances, ice as thick as glass was formed a mile from New-York, when an accurate thermometer in the city fell no lower than 40 deg. Hence the great error of determining the temperature of a climate, by observations made in a large city; which is often done in Europe.

The mean temperature of the climate in England is 48 deg. That of Paris, 54 $\frac{1}{2}$ . This difference is owing to the insular situation of England; the atmosphere in the vicinity of large tracts of water being always more temperate, than on continents at a distance from the sea or great lakes.

The following is the mean temperature of the climate of the respective places, ascertained by observations.

London, north latitude,	51 $\frac{30}{60}$	temperature,	48 $\frac{0}{10}$
Paris,	48 $\frac{50}{60}$		54 $\frac{5}{10}$
Quebec,	46 $\frac{48}{60}$		42 $\frac{50}{10}$
Rutland, (Vermont,)	43 $\frac{34}{60}$		43 $\frac{1}{10}$
Salem, (Massachusetts,)	42 $\frac{30}{60}$		47 $\frac{0}{10}$
Hartford, (Connecticut,)	41 $\frac{44}{60}$		49 $\frac{5}{10}$
New-York,	40 $\frac{42}{60}$		52 $\frac{0}{10}$
Philadelphia,	39 $\frac{56}{60}$		52 $\frac{5}{10}$
Virginia, (Frederick,)	39	nearly	57 $\frac{0}{10}$
Charleston, (S. C.)	32 $\frac{44}{60}$		66 $\frac{0}{10}$

Allowing a trifle for differences of instruments, this table presents to view the various mean temperatures of the climates mentioned.

From this table naturally arise two observations. First the great difference between the climate in Europe and America, under the same parallels of latitude. Thus London in 51 degrees north, has a mean temperature; almost as mild as Hartford in 41. Paris in the 49th degree has a climate, nearly as mild as the northern parts of Virginia in the 39th, and warmer than New-York and Philadelphia in the 40th.

Again we observe the great effect of the ocean upon the climate. Salem in Massachusetts is upon the sea shore, and Rutland, in Vermont, fifty or sixty leagues distant; and one degree of latitude differ-

gravity and resistance. He supposed them to consist of vapor or smoke repelled from the nucleus by the force of the sun's heat. He seem to have been aware of the objection to this theory from the resistance that must be made to the ascent of the vapor, by the celestial ether; and therefore supposes an extreme rarefaction to take place, which removes that resistance.

But whatever rarefaction may be supposed, still it will remain an incontrovertible principle in physics, that no substance that has gravity can be supported, but in a medium which has *more gravity*. The vapor supposed in the present case could not be maintained in strait lines, without a medium of greater density to support it. Now, any medium capable of supporting vapor must furnish great resistance, and very much retard its velocity.\*

With these known principles in view, let any man calculate the velocity of vapor, driven from the nucleus of a comet, necessary to preserve a direction nearly opposite to the sun, in its perihelion passage.

Comets enter the solar system in various directions; the planes of their orbits making various angles with that of the ecliptic. Their orbits are nearly elliptical, and the sun is in one of the foci of the ellipsis.

By the universal law of planetary motion, according to which all revolving bodies describe equal areas in equal times, the mo-

ment in the position of the places; yet the climate at Rutland is  $3\frac{1}{2}$  degrees colder than at Salem. On the other hand, Quebec, remote from the sea, tho on a river, with three degrees difference of northerly latitude, has a difference of only  $1\frac{1}{2}$  degree in climate.

To ascertain the mean temperature of any given place, it is only necessary to plunge a good thermometer into water, taken from a depth, in which the temperature is uniform, at all seasons of the year.

The mean temperature of water within the tropics is not exactly known, but it must be very near 80 deg. by Farenheit. Water drawn from a depth of 200 feet in the West-Indies, is cooled by filtration in the air, above the earth in those hot regions.

The difference in the temperature of Europe and America under the same parallels, is nearly that of ten degrees of latitude.

See *Holyoke's Register of the weather, Mem. Am. Acad. vol. 2. part 1.*  
*Williams' Hist. of Vermont.*

\* I submit it to mathematicians whether on Newton's own principles, an atmosphere of density sufficient to support a cannon ball, would not retard its velocity, as much as the present atmosphere does a feather put in motion. If so his rarefaction does not in the least aid the ascent of vapor from the body of a comet,

tion of comets must be very rapid in their perihelion. The comet of 1770 was calculated to describe an arch of 50 degrees in 24 hours. This seems hardly credible ; but many comets describe an arch of 180 degrees, a semi-circle, in 30, 40, or 50 days.

The perihelion distances also of the various comets are very different, and so are the lengths of their tails ; some of them extending a small distance, and others to 60 and 80 millions of miles.

Suppose the perihelion distance to be 30 millions of miles, and the length of the coma to be 70 millions. In this case the extremity of the tail must be 100 millions of miles from the sun. Now, either the vapor which is supposed to constitute the tail, must be shot from the nucleus with such rapidity, as to reach the extreme point of the coma, in a few hours ; that is, it must pass through 70 millions of miles, in a very short time, to preserve a direction nearly opposite to the sun ; or the whole coma must move forward with the nucleus. In the latter case, the extremity of the coma must pass along the periphery of a circle,\* whose radius is a line from that point to the sun, or 100 millions of miles. Of course while the comet describes an arch equal to a semi-circle, the extremity of the coma must pass through the space of 150 millions of miles. I believe no kind of vapor of which we have any knowledge, could perform either of these journeys in the time given.

On the other hand that gravitating substance would not have passed thro the distance supposed, from the creation of the world to this time.

On subjects of this kind, we cannot arrive at certainty. All we can do is, to reason from analogy and from probable conjectures. We know of no substance in creation, capable of producing the phenomena of the comas of blazing stars, except electricity or light. No other species of matter passes with a rapidity that will solve the phenomenon of the length of the coma preserved in a direction opposite to the sun. The theories of Kepler and Hamilton are more rational, than that of New-

\* The figure would not be a circle, but it is not material to the argument.



ton. The tails must consist of electricity repelled from the nucleus by the force of the sun ; or must be merely the rays of light colored by their passage thro the comet's atmosphere. These hypotheses may not solve *all* the phenomena ; but they will account for the principal ; and are repugnant to no philosophical principles.

The curvature of the coma has been alleged as an objection to this hypothesis. But in fact this is a confirmatory argument in favor of it ; for it is analagous to the curvatures formed by ascending streams of electricity in the lumen boreale ; indeed it seems to be a law of electricity to move in bending lines ; and for any thing we know, this phenomenon may result from the nature of that species of matter, and be independent of resistance.

In regard to the transparency of the tail, it resembles also the lumen boreale. Thro both of these luminous appearances, the stars shine with undiminished lustre ; but vapor, however rare, would refract their light, and in a certain degree, interrupt our vision.

An Essay on Comets by Andrew Oliver, published 1772, ascribes the tails of comets to air extremely dilated and repelled from the nucleus by the power of the sun ; but this hypothesis is liable to all the objections stated against the theory of Newton.

My own opinion respecting the material system, is this ; that an atmosphere, the basis of which is electricity, fills infinite space and involves in its bosom all the solid orbs which shine in the celestial regions. This may be denominated the *mundane atmosphere*. My hypothesis rests on the following reasons.

First. The large meteors or globes of fire are formed in regions far beyond the limit assigned to the earth's atmosphere. Their altitudes vary from 40 to 80 miles. At the height of 80 miles, then, there must be the matter of an atmosphere, capable, of generating globes of fire of half a mile in diameter ; and of communicating sounds, as full and distinct, as the air near the earth ; for the explosion of one of those globes resembles thunder.

Secondly. The lumen boreale has been often calculated to be visible at an elevation of 7 or 800 miles. I do not rely on

the accuracy of these calculations, on account of the difficulties attending them. In some instances we are very certain that this light exists in the regions of the higher clouds.

Thirdly. The tails of comets must be matter, or depend on matter for their coloring by which they become visible. In either case we have evidences nearly amounting to demonstration that a material atmosphere fills the boundless regions of space.

Fourthly. But an argument of still more weight in my mind, is one drawn from the necessity of such an atmosphere, as the medium of attraction and repulsion—the principles that connect and bind together the vast orbs that roll in etherial regions. I can have no idea of such an immense power exerted in an immense void or vacuum.

It seems probable that the parts of our atmosphere which constitute weight, and are supposed to influence the barometer, are limited to the distance of a few miles from the earth. Water, for instance, is a substance destined to answer certain purposes on the globe, and is probably confined to its neighborhood.

But the principle of electricity may be, and undoubtedly is, a nongravitating and permanently elastic substance. This may be diffused through infinite space, and by its amazing elasticity, may be capable of communicating motion or force from planet to planet, with the rapidity of light.

Newton supposed infinite space to be filled with a subtle substance which he called *ether*. Had this great man been acquainted with the laws of electricity discovered since his days, he probably would have exchanged the term *ether*, for *electricity*.

By means of this powerful principle, the planets all influence each other; and become the means of diversifying each other's seasons; sometimes by attracting, sometimes by repelling, and sometimes disturbing the proportions of this substance, or influencing its mechanical laws, by which it is combined or decomposed with other atmospheric substances.

Hence we may account for the frequency of earthquakes, volcanic eruptions and violent tempests, under particular phases of the moon, and especially during the proximity of comets. The electrical matter accumulated in the earth by its own laws, or by reason of an unusual demand at extra may, during the ap-

proach of these orbs, be suddenly called into action, and occasion extraordinary tumults in the atmosphere.

Perhaps also we may, in this hypothesis, find a solution of the phenomenon, so interesting to man, and so mysterious, why the approach of comets never fails to be attended with epidemic diseases. The fact, in regard to comets which come near the earth, is unquestionable; and it is equally certain that earthquakes, volcanic eruptions, meteors and many other electrical phenomena, are, at such times, more numerous and violent, than at other times.

Now it is proved by experiments that the fibres of living animals are the most perfect conductors of electricity, while the integuments which cover them are non-conductors. A consequence of these principles must be, that in all the motions or operations of electricity in the atmosphere, the nerves must be the principal subjects of its influence. Hence if the atmosphere is, at times, electrified beyond the degree which is usual, and necessary to preserve the body in a due state of excitement, the nerves must be too highly excited, and under a continued operation of undue stimulus, become extremely irritable, and subject to debility. Shall we not find, in this hypothesis, a rational solution of the phenomenon which has puzzled medical men, the excessive irritability of the nervous system, in times of epidemic diseases, which facilitates the invasion of fever? Shall we not account for the eruptive diseases which always precede pestilential epidemics, on the principle of the great debility of the extreme vessels, induced by the weakness of the nerves which spread over the human body near the surface, by which means these vessels are rendered incapable of performing their usual secretions? Shall we not be able to account for the remarkable coincidences in time between the influenza, and unusual electrical phenomena, as volcanic eruptions and earthquakes? May we not account for epidemic measles, in those years when the atmosphere shows evidences of high electrification? And will not this principle explain the diseases among animals, the defect of vegetation, and the extraordinary generation of insects, during pestilence? It is well known that vegetation may be greatly accelerated by artificial electricity. Is this effect produced by what is called ex-

itement? And if so, how do we know that a similar power, operating on the elements, may not call into existence innumerable insects? To what other principle shall we ascribe the *unusual* size of common insects, when they precede and accompany pestilence, a fact well attested? There must be a cause for these phenomena, and where shall we find it, but in the universal principle of excitement?

It is now agreed among philosophers that electricity is the immediate agent in the formation of rain, snow and hail. In confirmation of this theory, my enquiries into the cause of epidemic diseases have led to a discovery, that those years when volcanoes discharge great quantities of fire and lava, including some months before and after the discharges, are by a great difference, most productive of hail. Hence the immense damage done by hail-storms in those seasons which are excessively dry and hot; these years being closely attendant on volcanic eruptions. The theory which ascribes hail to extreme cold is defective. We know that pieces of ice of three, six and even nine inches in circumference sometimes fall in hail-storms. By the laws of gravity, a hail-stone must begin to fall, as soon as it begins to be formed; and as it requires but a few seconds to descend, it is easy to conceive that mere cold cannot occasion a congelation rapid enough to form pieces of ice of half a pound weight. The process is electrical, and almost instantaneous; and we know that real snow may be artificially and instantly produced by means of condensed air and electricity. Hence we are led to the causes which connect severe winters with volcanic eruptions; we derive the extreme heat of summers and cold of winters, which so generally accompany pestilence, from the same cause, a superabundance of electricity.

Hence we are led also to the cause of the apoplexies, lethargies and eruptive diseases, which almost uniformly follow great volcanic discharges and earthquakes in Italy. The system, and especially the nerves, are excessively excited, and lose their energy.

It is on the same principle also that we explain the phenomena of freezing, when the thermometer is above the usual point of frost. This has been observed near volcanic mountains, where the atmosphere is highly charged with electricity. In 1730,



Dr. Cyrillas found by a thermometer made by Hawksbee, that water, near Vesuvius, froze with the mercury 10 degrees above the freezing point.

Phil. Trans. No. 424. Bad. Mem. vol. 9. 299.

The nature of this element, electricity, is little understood. It is the modern opinion that heat and light are only modifications of the same element. This is analogous to what we know of water, which exists in the form of water, of visible vapor and air.

It is supposed that electricity cannot be insulated in the human body. But if it cannot be insulated in the form of *electricity*, may it not in the form of *heat*, and thus be the direct cause or matter of inflammation? If it can be accumulated and insulated in this form, may not conductors be formed to draw it off in the form of electricity? Mr. Vinal relates that he speedily removed local inflammation occasioned by a burn and scald, by the application of a negatively charged electrical machine.

Mem. Amer. Acad. vol. 3. 244.

Should this doctrine be well founded, the success of metallic points in removing topical inflammation, will be explained and established.

The proofs of the altitude of the atmosphere from the power of refracting light, are now known to be fallacious. No man will suppose the atmosphere to be less elevated, in the equatorial regions, than in the polar circles; yet the duration of twilight, under the equator, being less than in places remote from it, proves that the power of refraction will not determine the height of the atmosphere. The power of refraction is in a ratio to the diminution of heat, or increase of cold, in the atmosphere; or perhaps to the increase of electricity.

Nor will it be correct to say that the power of refraction depends on the density of the atmosphere, unless density can exist independent of gravity. The atmosphere in the polar and temperate regions raises the barometer no higher, than under the equator; nor is the mercury in barometers generally higher in winter, when the thermometer, by Fahrenheit's scale, is 10 degrees under cypher, than in summer when it is at 98 deg. the temperature of blood heat.

If density implies or involves in it gravity, then the atmosphere at the equator is as dense as in any distant latitude, for the barometer is as high in one as in the other. But if the atmosphere is as dense and as heavy, *ceteris paribus*, in one latitude, as in another, then the powers of refraction, in different latitudes, which are various, cannot depend on density.

It is indeed very questionable whether density and gravity are the principles which wholly influence the barometer. The barometer falls, as it is elevated above the surface of the earth; but the atmosphere retains all its powers of sustaining respiration and circulation, at an altitude of 15,000 feet.

What are the aerial phenomena that attend a fall of the barometer? How can the weight of the mass of air surrounding the globe, be suddenly taken off, over a whole continent? What becomes of its gravity, and the principle of attraction on which it is supposed to depend? Are they removed, expelled, or suspended?

I suspect the theory which assigns to the barometer the province of determining the *gravity* of air, is fundamentally defective; and that instead of variations in its *weight*, it indicates only variations in the combinations of its parts, which diversify its *elasticity*, and its operation on the barometer, as well as on the human body. When the atmosphere is full of vapor, the barometer usually falls, and we feel a depression of spirits. It can hardly be true, that the pressure of the whole atmosphere is less, at such a time, than when the air is clear and the barometer high; for this vapor circulates near the earth and the higher regions of the air are as clear and as ponderous as usual. If the density of the air near the earth should be lessened, the consequence must be the air from higher regions, which retains its gravity, must instantly rush in to supply the defect.

The only way to account for the variations of the barometer, appears to be on the principle before mentioned. The air appears to be less elastic, when the heat is combined with vapor, and the mercury falls. It seems necessary to take into view these considerations in order to solve the phenomena. The general pressure of the atmosphere or gravity, is probably uniform, and it is

the various changes in its elastic powers, which occasion the vibrations in the barometer.

Every dairy woman knows that thunder and lightning will almost instantly coagulate milk ; that is, when electricity is united with vapor, and passes, in a visible form, from cloud to cloud, or between the clouds and the earth, *milk turns*, or coagulates—so it does, during a rainy day, in summer, without thunder, with the thermometer at 64 deg. as I know by observation. This condition of the atmosphere, may be called its *decomposed* state. The barometer falls, vapor becomes visible, the functions of the body are languid, milk coagulates, objects contract mould, in short the atmosphere is unelastic, and ill-fitted to maintain vigor in animal or vegetable bodies.

Thus also the fermentation of beer is checked and destroyed by thunder, and no human art has been found to restore it. By what process of electricity is this sudden change effected ?

I have remarked in the preceding pages, that a pestilential atmosphere is not corrected or moved by the force of wind—no tempest expelling an epidemic fever from a city, unless at the close of the season, and accompanied with heavy rains. How can we solve this difficulty, but upon the hypothesis of an electrical atmosphere which is stationary ?

Dr. Franklin proved that “an electrified cork ball at the end of a silk thread, whirled never so rapidly through the air, for a length of time, lost none of its electricity. He found also by an experiment that an electrical atmosphere raised round a thick wire, inserted in a phial of air, drives out none of the air ; nor on withdrawing that atmosphere, would any air rush in.” On Electricity, Lond. ed. 97. It is also proved that a most violent blast of wind, thrown across a stream of electrical matter, has not the least effect upon it.

These experiments prove that air furnishes no sensible resistance to the motion of electricity, and that it exists in air without expanding or compressing it. In short it proves that electricity acts entirely by its own laws, and is not controlled by the agitations of the air.

Will not these observations throw light on the fact of a stationary atmosphere in cases of pestilential epidemics? Is not electricity the basis of the common atmosphere, and immoveable by wind? And does not a pestilential air consist partly in some combinations of this element, with other aerial substances, which are not moved by wind? This is suggested merely for consideration; for it appears to me improbable. Frost destroys the pestilential condition of the atmosphere, and this is supposed to act upon the deleterious substances arising from the earth, or human body. Besides, a pestilential atmosphere rises but a few feet above the earth, which indicates that its pernicious qualities are dense and gravitating substances.

Indeed two causes seem to concur in the origin of pestilential fevers—an electrical condition of the atmosphere which renders the nervous system extremely irritable, and the body of course prone to fever; and a collection of morbid matters arising from living\* and dead animals, and putrefying vegetables. Wind may remove the latter cause, if accessible, which however is never the case in large cities; but cannot affect the influence of the former. Frost has access to all morbid causes, and renders them inert. It also reduces the stimulus acting on the human body, and renders it less irritable. But the electrical stimulus remains. Hence altho the progress of the fever is arrested by cold, the type of it is visible in the diseases of the winter. The irritability of the system, from electrical causes, still remains; and gives to the fevers of winter the peculiar symptoms of pestilential or typhus pleurisy, and peripneumony.

A remarkable property of electricity is to give polarity to the needle of a compass. A violent stroke of electricity, destroyed the virtue of the loadstone, and reversed the ends of the needle of the compass on board of Capt. Waddell's ship in 1751; and a suitable discharge of that element will give polarity, like the

\* I mention the morbid matters from *living* bodies, among the causes of pestilence. I am persuaded that perspiration in cities furnishes more poison than streets and alleys. It fills all close rooms, especially bed rooms; in close-built streets, it infects the very atmosphere; and a more virulent poison does not exist, than perspirable matter in a condensed and fermenting state. This can only be destroyed by a liberal use of water.



magnet. Hence it is concluded that magnetism depends on electricity, but in what manner, seems to be mysterious.

It is well known that the needle is subject to variations, which are different in different parts of the earth ; and in some degree, periodical. It has also a small diurnal variation ; receding from the east or influence of the sun from 8 o'clock in the morning to 2 in the afternoon ; and from the west, or the same influence, from 2 o'clock to 9 P. M. ; and during the night, remaining stationary. Is not this owing to the repulsion of light and heat ? If so, is there not an analogy between this diurnal variation, and the phenomenon of polarity ? If light and heat, falling on one side of the needle, repel it in a small degree ; is it not rational to conclude that the equatorial heat, should repel the magnetic point, and direct it to the north ? That is, the needle points towards that portion of the atmosphere which is most perfectly electric.

It may be objected that the needle does not always direct itself to the same point. True ; but there is some periodical revolution in the electricity of the terrestrial regions ; as the appearance and disappearance of the lumen boreale, at certain periods, warrants this suggestion. It seems to be admitted that there is a current of electricity from the equatorial regions towards the polar regions, within the earth, and in the upper parts of the atmosphere, a current of the same element from the poles towards the equator. This idea is derived in part from the lumen boreale, and receives countenance from the fact, that a bar of iron, standing directed towards the pole will acquire polarity or magnetic properties ; but directed towards other points in the heavens, no such effect is produced ; indicating a stream of electricity passing through the bar, from the center of the earth towards the pole, but not in any other direction.

Should this idea be well founded, and should it be admitted that the lumen boreale is a current of electricity from the north to the south, will not the periodical appearance and disappearance of this light, indicate a revolution in that current about the axis of the earth, or perhaps an axis of its own ? If so, on what laws does it depend, and how will it agree with the variations of the compass ?

It will be said, that the variations are different in different places, and not uniform in the same place. True; but the general course of variations in the same place is tolerably uniform.

With respect to different degrees of variations in various places, I have one observation that is probably new. It is very probable, if not evident, that the *distributions* or *forces* of electricity are different in different quarters of the globe. I say *distributions* or *forces*; for a difference in the state of existence or modes of acting, will as well account for the phenomena, as difference in quantity. My reasons for this opinion are, that the barometer has different altitudes, in different places, at the same time. The mean altitude for a month or a year, in places of the same elevation, is very various. Hence we conclude that the weight of the atmosphere cannot be the cause of these variations, for this on a level of the ocean, must, on hydrostatic principles, be every where the same. Yet the actual differences amount to one half or two thirds of an inch.

See Phil. Trans. No 435. Bad. Mem. Vol. 10. 81.

It is easy to account for this difference of pressure on the principle of different combinations of the electric principle with vapor or other local matter in the atmosphere, which may vary the *force* or elasticity of the air; but I do not see how the *weight* of a fluid alone, whose pressure must be equal, if of equal height and density, can account for these differences. It is utterly repugnant to all known principles of the equable pressure of a gravitating fluid, to suppose a mere change in the form or composition of that fluid, should alter the absolute weight. Water admits none of these varieties, being always of equal density and gravity at equal altitudes.

On the same principle of a difference of pressure or elasticity in air and water, without a change of weight, perhaps we may account for the very different elevations of the tide in different places, and in some instances, in the same latitude. It is rational to conclude that the electricity is various in its combinations or quantity, in different places, according to the heat of the climate, the neighborhood of land and high mountains, or perhaps to the seats of volcanoes? The fact that tides do not rise as high, on the main ocean, as near land, seems to countenance this idea.

It seems to indicate that the medium by which the moon influences the water, has different powers near the land and at a great distance.

Another fact that seems to favor the hypothesis that electricity is the instrument of tides, is, the great irregularity of tides. In many instances there have been preternatural ebbings and flowings of the tide—sometimes the river Thames, for instance, has been left almost dry, for many hours, when there has been neither wind nor earthquake to account for the phenomenon.

\* A recess of this kind is mentioned in 1114, when the Thames for the whole day, on the 15th of October, was so low, that children walked over between the Tower and London bridge. In 1247 there was a cessation of the flowing of the tides for three months, before a severe earthquake. See Short vol. 2. 145. I should not be inclined to credit these relations if modern observations did not serve to confirm them. On the 11th of March 1785 and 25th of January 1787, the Tiviot, a large river in the south of Scotland, receded and left its channel dry, in the former instance, *two hours*, and in the latter, *four*. No convulsion of the earth was known in that neighborhood, nor within two or three weeks of the first instance. An earthquake happened on the 26th of January, the day after the second instance, but could not be the cause. A similar recess happened on the day of the earthquake, in the river Clyde. On the 12th of September 1784, in perfectly calm weather, the water in the Lock Tay in Scotland suddenly ebbed 300 feet and left the channel dry, then flowed again, and thus alternately rose and fell for two hours. The same phenomenon, in a less degree, occurred in several succeeding days. Sinclair, vol. 6. 624.

The facts related of the sea and rivers in Holland on the day, but not at the hour, of the earthquake, at Lisbon, in 1755, when ships snapped their cables, and water dashed over the sides of vessels, without the least sensible motion of the earth, are strong proofs of the same insensible but immensely powerful action of the electricity of the globe. The swelling of the ocean in the time of earthquakes is not so much owing to the rising of the earth beneath, as to the force of electricity. The intumescence sometimes begins before the shock, as it does before hurricanes in the West-Indies.

In Scotland, during the great earthquakes in Calabria, in 1782, the water in the locks was agitated without any motion of the earth, and the mercury in the barometer fell within the tenth of an inch of the bottom of the scale. On the 12th of February 1787, the barometer at Edinburgh fell nearly to the same point.

These phenomena can be resolved into no cause but some operation of electricity, and they add much weight to my suspicions, that tides are governed by some laws of electricity, which are influenced by the phases of the moon.

The great fall of the barometer in Scotland is a strong evidence that the same energetic principle governs that instrument. It is absurd to suppose the atmosphere could have lost such a portion of its weight. Indeed it is far from being impossible that the rise and fall of the barometer may be occasioned by the force of electricity acting on the quicksilver itself.

If any person should hesitate to believe that a mere change in the

These irregularities have invariably happened in years, which have been remarkable for electrical phenomena. To this point I have paid particular attention. They are not always attendant on earthquakes, or volcanic eruptions; but they occur in the same year, or near the same period; evidencing that when those visible discharges take place, insensible discharges take place in remote countries, and on the opposite side of the globe.

Should it be admitted that electricity may be unequally distributed or operate with different forces, in various places, according to its combinations with aerial substances, at different times, we may find some probable causes of the great diversity of diseases in the same year, as well as of the different heights of the barometer. The stimulus applied to the human body, may be different in various places, according to the predominant operation of one or more of the following causes.

- I. Soil, which may affect the air in various ways.
- II. Situation in regard to elevation, to water, hills, mountains, minerals, fresh air.
- III. The population of places, and all the consequent evils of noxious exhalations.
- IV. The cultivation of a country, which has a most salutary effect on the atmosphere.

It is very certain that the condition of the atmosphere is very different, in places which appear to be equally favorable, to combination of electricity and aerial substances, may vary the spring or elasticity, without the least alteration of their weight, let him attend to the different powers of wine, cyder or beer, before and after fermentation begins. It is not presumable that the liquor has more weight in a state of fermentation, than when quiescent, before that process begins; yet the force with which it acts upon the cask containing it, is increased perhaps a hundred fold. I suspect that the changes in the atmosphere which affect the barometer and the human body are analogous to what we observe in liquors—mere alterations in the combinations of the parts, producing various elastic powers, without any change in the general gravity of the atmosphere. Hence it is easy to conceive that the elastic power of the atmosphere may be diversified by substances exhaled from the earth, in different situations; this may occasion small variations of the barometer in two distant places, having the same altitude, and be one cause of differences in the salubrity of the air.

This idea is still better illustrated by the different properties of gunpowder in the kernel and in a state of explosion. In the former state, an immense elastic power is confined to a compass inconceivably small—by adding to it a spark of fire, this elastic power is set loose with tremendous effects.



health. Children and valetudinarians are very sensible of these differences. It is hardly possible to remove an indisposed person a distance of five miles, without a sensible effect on his health; he is better or worse in his new atmosphere. Under the combined operation of such various causes, we are not to be surprised at the irregularity in the appearance of autumnal and epidemic diseases.

Much labor has been employed to investigate the cause of sensation and perception. The most able philosophers maintain the necessity of a medium through which we receive impressions of distant objects. The rays of light are supposed to be the medium of vision, and an elastic air, the medium of sounds. But by what means impressions on one part of the body are almost instantaneously communicated to the other parts, may be a question of difficult solution.

It appears to me probable that the medium by which impressions are conveyed from one object to another, is that most elastic fluid, the principle of fire or electricity, which pervades every object and is diffused through creation. A motion given to this fluid in the brain is instantly conveyed, by its elastic property, to the remotest fibre, and vice versa. The same fluid, diffused through the solar system, and all creation, may, and probably is the medium by which distant orbs make impressions on each other.

It is absurd to suppose that the bodies that compose the solar system, or any other system of worlds, can be suspended in an immense void, and revolve about a common center, at distances of many millions of miles, without some medium of connection; some tie to bind them together. It is absurd to suppose that an influence can be exerted between them, unless thro' the medium of a substance. This substance is doubtless that subtle, elastic fluid which constitutes the basis of fire, heat, light, or electricity. This fluid, receiving an impression from one globe, in any part of space, may impart it to another, in a few moments, by means of its elastic powers. This theory accords with the known properties of electricity; and affords a sublime idea of the magnificent structure of the universe.

The heat of a fever may proceed from the same fluid ; and hence the value of water, as a conductor, to carry off the heat of a fever. In all fevers, this is the indication of cure given by nature. Hence the obvious and prime utility of perspiration, in the cure of pestilential fevers, which seize the very seat of life, the essential organs of the nervous system—parts of the body which medicines taken into the stomach do not easily reach. Perspiration and salivation, by throwing out moist and fluid substances, thus conducting the heat or electric principle to the surface, seem to be the most certain remedies.

This elastic principle, if any thing, is the substance which has given rise to the doctrines of galvanism, animal magnetism—and Perkinism. But if those doctrines have any just foundation, the nature and modifications of the principle are so little understood, that all attempts to reduce the doctrines to certainty or system have hitherto been defeated. Primary causes elude all the researches of man, and compel him to acknowledge his ignorance.

*On the popular modes of guarding against infection.*

MANKIND have, in all ages, resorted to a variety of expedients to guard themselves from pestilential distempers, and to check them when existing. The use of aromatics as a *pestifuge*, is as old as the journey of the Israelites from Egypt ; for when the plague had broke out among them, Aaron took his censer, put on *incense*, and standing between the dead and living, the plague was stayed.

Numb. xvi. 47.

Herodian relates that in time of pestilence, the Romans stuffed their nostrils with aromatics, but without success.

Mignot relates that the Turks, at this day, make great use of aromatics, to guard themselves from the plague.

Hist. Turk. Emp. vol. 2.

Diemerbroeck chewed tobacco as a preservative, and alleges many instances of its good effects. It is not improbable that this article, by promoting discharges of the saliva, may prevent the

noxious matter from entering the system by the fauces, which are principal agents in absorbing the poison. Any other herb that will promote spitting, would probably be equally salutary. Washing the mouth frequently with fresh water is very useful in the same way; and nurses should never inhale the effluvia of the sick, without immediately washing the mouth.

In our country, many similar expedients are employed toward off infection. Camphor is worn in little bags around the neck, or frequently applied to the nose.

It does not appear that aromatics and pungent salts have much effect in resisting the attacks of pestilence. There is probably no attraction between the particles of such substances and the poison of the plague. Stimulants are useful, in some cases, when applied to the whole body; but applied to the nose, their effect is local, and wholly inadequate to the purpose. A spoonful of fresh water, taken frequently into the mouth, and discharged, is better than a pound of camphor; for water mingles the infectious particles with its mass, and renders it harmless or carries it off.

It is possible however that, in some cases, an atmosphere impregnated with the stimulating effluvia of spices may preserve the body from the attacks of this disease. An instance is related in *Acta Eruditorum* of the year 1721, published at Leipzig, that persons living near storehouses of spices escaped the plague. We should however be cautious of drawing conclusions from a single fact. The effect may have proceeded from an unsuspected cause.

Skenkies, from Alex. Benedictus, informs, that it is a custom among the Tartars in the Crimea, to kill their dogs in time of pestilence and suffer them to putrefy on the earth; alleging that the fetor arrests the plague by changing the air. Page 773. This is certainly a most singular remedy, and the fact requires good authority and explanation to induce belief. It however corresponds with some instances, in which pestilence has been least severe in filthy places.

The burning of powder is held to be useful in checking the plague, by generating respirable air. Lernnius, lib. 2. The blowing up of a magazine has been said to put a stop to pestilence.

During the civil wars in England, which ended in the death of Charles I. Fuller relates that the plague in Litchfield was

arrested by the firing of cannon, at the siege of that town. The pious author says that many ascribed this to the *purging of the air by the bullets*, but divines ascribed it to God's good providence.

It is related in Van Swieten that the fermentation of wines on the Moselle, in time of vintage, had a most sensible effect in checking the plague.

It has been customary to burn resinous substances in the streets to stop the progress of pestilence, but without any sensible effect. It was attempted in Philadelphia in 1793 and in New-York in 1795, but the ill success has prevented a repetition of the attempt.

Authors relate that the ancient physicians put a stop to the plague, by enkindling large fires in the streets. I consider the fact as doubtful, for it is not agreed among writers, whether this was done by Hippocrates, or another man.

It was however on the strength of the story, that great fires were kindled in London in 1665; but the deaths were more numerous on that night, than they had been before. If fire can be of any use in the plague, it must be by creating motion in a stagnant air, or by drying a moist one. The latter effect is that which Galen supposed to have resulted from the fires used by the ancients; and there may be situations and times, when a fire in infected houses may be applied to good purpose, by removing damp stagnated air. But it is questionable whether the atmosphere of a city can be sensibly and beneficially changed by public fires; and the experiment is very hazardous, for if the fire should be communicated to the buildings, it would not only consume property, but double the rage of pestilence. Thus the plague in Constantinople in 1539 was greatly inflamed by a fire which consumed a large part of the city. Fatigue and distress, added to the previous causes, multiplied the new cases, and one third of the inhabitants perished.

Mignot's Hist. Turk. Emp. vol. 2.

Every thing which collects, fatigues and alarms people, at such times, is very prejudicial; as the fire in Philadelphia, in 1793; in Providence, in 1797, and the launching of the frigate in Baltimore, in the epidemic of the latter year.



The only effectual safety is in flight. When a few cases of the plague first appear, they should be removed, or other precautions taken to prevent any ill effects from infection. They may be sporadic cases, and such precautions may save a city from the further progress of the distemper, among visitors and attendants. But if these precautions prove fruitless, as they usually will, and as they *always* will, when the disease is the effect of an atmospheric principle, which is the fact, nineteen times in twenty, the only certain means of security, are in quitting the city. The practice of *flouting up*, which is customary in the east, if the people can live in high rooms, may save life, but it is very inconvenient, and less safe than an abandonment of the infected town.

#### *On Venesection.*

THE extensive mortality occasioned by the plague, the rapidity of the disease, and the virulence of its poison, which often defies all medical aid, have called forth all the exertions of talents and knowledge, to invent some mode of defeating its ravages.

It is agreed on all hands, that perspiration, if induced on the first seizure of the patient, is the most effectual prescription. Hence the universal use of alexipharmics in pestilence.

But it often happens, that no application whatever will excite perspiration, and especially, in the later stages of the disease.

No part of the practice of medicine has excited such warm controversies, as venesection. It is foreign from my plan to discuss this question; my remarks are intended rather to explain the cause of this diversity of opinions, from my observations on historical facts.

Most of the medical writers who were personally acquainted with the true plague, in former ages, when it frequently overspread Europe, have decided against bleeding.

In the plague which ravaged all France in 1565, Charles IX. then king, demanded of all the physicians to give information of the best mode of treatment, and they unanimously decided against the practice of bleeding liberally.

Ambrosius Paræus, in the same plague, made extensive enquiry, as to the success of bleeding and purging, the answer of his medical friends was, that in all cases, these evacuations, if powerful, were fatal.

Sennertus, p. 356.

Forestus, observed, in the plague of 1557, at Delph, that those all died, who were bled after twelve hours from the invasion of the disease. Palmerius has testified to the same effect, and so has J. Ant. Sarracenus, in describing a plague in Geneva.

Fallopianus remarked in the plague which raged from 1524 to 1530, that all died who were bled. This was observed also by H. Florentus, a physician of Leyden—by Simonius, in the plague of 1602—Hildanus, in the plague at Lausanne, and a multitude of others. See them collected in Diemerbroeck, de peste, 130. and sequel, who found in the plague at Nimeguen “venesectionem damnosissimam fuisse”—bleeding was extremely injurious.

On the other hand, we have in the same author a long list of names of eminent physicians, who warmly advocate venesection. To this list may be added the name of the celebrated Sydenham.

The source of this difference of opinion is doubtless the difference of the symptoms in the disease under different constitutions of air, in different places, and in different habits. The great difference in the same disease, under different epidemic constitutions, was most distinctly observed by Sydenham; and this variety seems to constitute no small nor easy part of the physician's investigation.

Sydenham observed what is undoubtedly true, that the same disease is characterized with different symptoms, under different conditions of the air; and often the same apparent state of air produces very different diseases. It is very evident, that the visible qualities of the seasons are not the only circumstances that modify diseases. The learned Boyle remarks the great diversity in plagues, requiring remedies altogether different.

Vol. 3. p. 60.

Hence at one time, the plague, in a few hours after invasion, induces a state of debility, in which bleeding will, in almost every case, accelerate death. At other times, the disease may main-

rain, for two or three days, a highly inflammatory diathesis, in which a timely, and judicious use of the lancet may prevent a fatal termination.

I am persuaded that history will justify these remarks, and make practitioners very cautious of prescribing for the name of a disease. This caution is more especially necessary on the first appearance of an epidemic, before the ruling type of the disease is fully manifested. The doctrines of Sydenham, in regard to the controlling influence of different constitutions of air, seem not to have been studied and pursued, with the diligence due to their importance. They are the basis of an interesting branch of philosophy as well as medicine; being grounded on those varieties incident to the same object, which characterize all the works of creation—varieties which constitute the revolutions in the same disease, analogous to those already described in a series of epidemics and in many other phenomena of the world.

*On Vapor or Mephitic Air, extricated from the earth by means of discharges of the electrical fluid.*

I HAVE suggested in the preceding pages, that epidemic diseases may be sometimes occasioned by a vapor extricated from the earth. That such has been the fact in cases of earthquakes, has been proved by several examples; that a deleterious vapor may be expelled from the earth and produce diseases, without a concussion, appears from the case at Rouen in 1753, and the sickness and death of fish are strong evidences of the truth of the principle. Other considerations lead to the same result.

In the account which Sir W. Hamilton has given of the eruption of Vesuvius in 1794, Univ. Mag. Oct. 1795, it is observed, that “after every eruption of that volcano we read of damage done by mephitic air, which coming from under the ancient lava, insinuates itself into low places, as cellars and wells near the foot of the mountain.” Several instances happened after the eruption of 1767, of persons going into cellars and being struck down with this vapor, who would have died, without as-

sistance. This vapor on an open plain subsides near the earth, being heavier than common air; but it fills cellars, wells and hollow places, so as to endanger life, and actually proves fatal to birds, beasts, and vegetables; sometimes to men. This vapor or fixed air is generated by the action of vitriolic acid on calcareous earth; and by other means in the immense laboratory of Nature's works.

The facts here stated and which are well known to every chymist, will perhaps account for the *damps* in wells, as this fixed air is called in popular language. It is a common idea that air will become impregnated with this vapor, by mere stagnation in a well. This is probably a mistake. Nor is it probable that any substances in the well generate this air. It cannot proceed from water, nor from the earth, or stones, or rocks which compose the sides of the well, unless the earth is different from common earth. It is probable therefore that this mephitic vapor is expelled from the earth by force of internal heat or electrical fire; and that this happens not uniformly, or at any certain times. I suspect that the discharge of it happens at particular times in various parts of the earth, from causes not yet explained; and that it occasions epidemic diseases among men, beasts and fishes. To aid us in an enquiry of this kind, it would be necessary to examine a great number of facts, and discover whether this mephitic vapor is ever found in wells, except when epidemic diseases of some sort or other prevail among animals.

On the 30th of August 1795, just after the pestilential fever appeared in New-York, two men fell victims to this vapor, in a well belonging to a brewery in Pine-street, within a few yards of the house where I then resided. The well had been dug but a few months, and was not used, but covered over with boards. It was about 25 or 30 feet deep, contained a few feet of water, and was so full of mephitic vapor, that a candle was extinguished within eight feet of the surface of the earth, as I found by experiment. This was during the sickness, and a question arises whether the two things were connected in cause. Had not a similar vapor been silently thrown from the bowels of the earth, over all the coast and region from New-Jersey to Connecticut,



for some months previous? And may not the sickness of the dyfters and shad on that coast, from 1794 to 1796, as well as the destructive epidemic angina, fevers and dysentery, be ascribed to that cause? I offer this hint to excite enquiry. Gov. Ellis, in a paper on the subject of hurricanes, Museum, vol. 9. 215, mentions, among the precursors of those tempests, thick vapors in the air "sensibly mephitic." If this vapor is the cause of diseases, it will account for the greater prevalence of them in low situations.

There is reason to suspect that this mephitic air is expelled from the earth, in considerable quantities, at particular times, but incorporating itself with the common air, it does not often prove fatal to men, altho it may lessen the vital powers of the atmosphere, and aid in the production of diseases.

In 1729, on the 19th of July, a Mr. Adams of Boston and his servant perished by this air in a well. Let it be observed that in this year, the influenza spread over Europe. Whether it was in America or not, I cannot learn; but the measles was epidemic in Boston, in that year; and other parts of America were sickly.

But what among other things inclines me to the opinion that this species of air is not generated gradually in wells, but is expelled from the earth suddenly, is a fact related in the same paper with the foregoing, Baddam's Mem. vol. 9. 4. Phil. Trans. 411; that on the 9th of May preceding this accident, two men at work in a well in School-street, Boston, were suddenly attacked by this species of vapor, and came near losing their lives. The well had recently been dug and enlarged, the workmen experiencing no inconvenience; and that the vapor did not proceed from opening a new chasm, or breaking a new stratum of earth or minerals, is certain; for the men were not then digging, but stoning the sides of the well.

In Philosophical Transactions, No. 119, it is said that dampas are generally observed to come about the end of May, and to continue during the heat of summer. At that season also they are most violent in mines infested with them, during the whole year. But by a subsequent paragraph, it appears that the writer

in that remark made no distinction between fixed air and inflammable.

If it is true that this vapor is expelled from the earth in spring and summer only or principally, to what cause shall we ascribe that circumstance? Not to internal heat certainly, for that at the depth of 20 feet is always the same. We may perhaps find a solution in the excited atmosphere of summer, which may occasion discharges of electricity.

It might be well for the world, if experiments were made to ascertain these points. If a vapor is at times thrown into the atmosphere from the internal parts of the earth, and becomes noxious to health, it is of great consequence to the world to know the fact, as this air subsides into the lower grounds, and might often be avoided. A deep covered well and not used, might be kept for this purpose, and a lighted candle or lamp let down to its bottom once a month. If there had been a discharge of mephititic air, it would be found in the well; but if the air of the well should be found good, we might conclude that the atmosphere had received no taint from subterranean vapor.

This subject deserves investigation. The herbage is at times affected by a dew or clammy substance, which is visible, tangible and offensive to cattle. Instances have been related in the preceding history. The honey-dew is a curious phenomenon, not well understood. This is a substance that resembles honey or wax, deposited on the leaves of trees, and attaching itself to blades of corn. It is sweet to the taste, and the honey-bee is seen to feed upon it. To corn it is very prejudicial, by causing a blast.

I have not been able to ascertain whether this is a periodical or an accidental phenomenon, nor to find the causes of it in the known properties of air or water. Is it the produce of a vapor from the earth; or of some unusual combination of aerial substances?

We live in a fluid, composed of various ingredients, each of which has its own properties, and by various combinations, and incessant changes, these ingredients are daily generating new properties. One day, the sky is calm and cloudless; the next, the

heavens are wrapped in vapor, and the earth deluged with rain. One moment, we are shrouded in chaotic darkness; the next presents to us the heavens and earth in a sheet of livid flame. Instantaneous is the transition from the silence of the grave to peals of thunder that shake the earth beneath our feet; and the field that smiles with its golden fruits, to day, is to-morrow torn with the raging tempest, stripped of its beauties, and converted into a barren waste.

Immersed in elements productive of these sudden and tremendous effects, how is it possible that man should pass through life without feeling inconveniencies from principles capable of such astonishing vicissitudes? Instead of wondering at the phenomenon of pestilence and other epidemic diseases, and hunting, with microscopic view, for a bundle of clothes in which to find the germ of a malady that desolates the earth, men would show more wisdom and more correct understanding, if they would collect facts, with care, examine them with candor, and endeavor by this process to arrive at some knowledge of the powers and effects of those elements which compose all animal bodies, and from whose operations are immediately derived all the vital energies. There we may find, altho we may not be able to comprehend, principles of disease as powerful and as universal as the laws of nature.

*On the revolution of certain Comets.*

SINCE this work has been in the press, I have had the curiosity to trace back the revolutions of two or three comets, whose periods were calculated by Dr. Halley, to find how far his astronomical calculations are verified by the history of the appearance of comets, in former ages. The following are the results.

The comet of 1682 Dr. Halley found to have a period of 75 years. If this calculation is exact, the same comet must have appeared in the following years. The first column contains the years when the comet must have appeared, supposing its period to be exactly 75 years—the second, contains the years when a comet appeared, according to the preceding history.

A. D.		A. D.
1757	1757	856
1682	1682	781
1607	1607	706
1531	1531	631
1456	1456	556
1380	1380	481
1306	1305	406
1231		331
1156		256
1081		181
1006	1005	106
931		31

I have found no mention of a comet in 1231, 1156, 1081, 931, 781, 706; but the physical phenomena at those periods, as severe winters, inundations, earthquakes, pestilence, &c. render it more than probable that a comet was visible, in those years, or in the next preceding or following. In some other periods, a comet is mentioned in the next year, to that which is designat-



ed in the first column; but I take this difference to proceed from the fractions of a year—the period of the comet not being exactly a year.

If these calculations and facts may be relied on, this comet must have appeared in the year 256, in the midst of the mortal pestilence, in the reign of Gallus and Volusian, and in the year 31 or 32, a little before the crucifixion of our Savior.

The calculations respecting the return of the comet of 1661 coincide remarkably with historical facts. Its period is supposed to be 129 years. If so, then it must have appeared in the years named in the first of the following columns—the second column contains the years when a comet did actually appear, according to the history in the first volume.

A. D.		A. D.	
1790	—	500	— 502
1661	— 1661	371	—
1532	— 1532	242	—
1403	— 1403	113	—
1274	— 1274	Before Christ,	
1145	— 1145	16	—
1016	— 1017	145	— 145 or 17
887	—	274	—
758	— 759	403	—
629	—		

I have no account of a comet in 887; but in page 112 of Vol. I. a severe plague and hard winter are mentioned, under that year. The events related in page 77, under the years 242 and 3, are such as lead me to suspect a comet, at that period, which corresponds with the calculations; but I have no account of any. The same remarks may be made respecting the events of the years 114 to 117, when Antioch was destroyed, as related page 70.

Of the events before Christ 16, I have no particular account. The three preceding periods of this comet, before Christ 145, 274, and 403, correspond with great pestilence. See pages 43

and 43—48—56 of Vol. I. And this might have been the star alluded to by Justin, in the passage quoted in page 43.

But we have an insuperable difficulty to these calculations—this star, if its period is 129 years, should have appeared in 1789 or 90; but no comet was seen. One appeared in the autumn of 1788, but I know not whether the elements of its trajectory corresponded with those of the star of 1661. Calculations of this kind are yet too uncertain to be the basis of a system.

It is greatly to be desired that the revolutions of the comets could be reduced to as much certainty, as those of the planets. Such calculations would enable us to account for many of the violent changes on this globe; and aid us to fix the era of certain great phenomena of antiquity: For no fact is better established, than that comets have a prodigious influence on the electricity of the earth and its atmosphere.

The comet of 1680 is supposed to have a period of 575; and the appearance of a splendid star of this kind in 1105 and 531, gives reason to believe the calculation just. If so, it must have appeared before Christ 44—619—1194—1769 and 2344. The latter year falls within 8 years of the period assigned to the deluge. But the uncertainty of ancient chronology leaves room to question all results from these calculations.

## POSTSCRIPT.

**I**N the course of my investigations into the origin of the bilious plague, I have had so many opportunities to detect the errors proceeding from *common report*, that I am led to question every fact that does not come directly from the persons concerned in the transaction related. I had such confidence, for instance, in the facts published and believed by the people in New-Haven, respecting the origin of the fever of 1794, in that city, from imported sources, that I had prepared an account of it for the press, before I called on the persons best able to give me correct information. On examination, I was surprised to find most of the supposed facts totally unfounded; and Mr. Gorham and Capt. Truman, the persons concerned, when informed of the reports which had been circulated on the subject, expressed their surprise that people should have propagated such tales, without calling on them for a true state of facts.

It was said and published that Polly Gorham, the *second* person seized with the fever, was present in Mr. Austin's store when the chest of clothes was opened. The gentleman who published this report, has since informed me that he had no authority for it, but the story of a child of six or seven years old. But Capt. Truman who opened the chest himself informs me, that Polly Gorham was *not* in the store at the time.

It was reported and is still believed, by most of the people in the town, that Isaac Gorham's wife washed infected clothes; but Mr. Gorham assures me that there is not the least foundation for the story, and he is astonished that such a tale could have been circulated. He cannot assign any good cause for the fever in his family, and is inclined to the opinion that no infection was received from the sloop.

It is possible and probable that some persons who came in the

sloop had been into Gorham's house; at least into the shop in the front room. And this is the only possible way to account for the propagation of infection from that sloop, even admitting that it contained infected clothing. But even in this case, it would seem strange that Gorham himself should escape, and his wife and niece who were usually in the back room, should contract disease. But the following facts which have been received from Capt. Truman, since the first volume was printed, will show the improbability, if not the impossibility, of such a communication of infection.

This sloop, called the *Iris*, arrived from Martinico at New-York in May. All her men and passengers were and had been, during the passage, in good health. The sloop of course was permitted to enter as a clean vessel, and she was hauled up to a wharf, where she lay ten or twelve days wind-bound, before she could proceed to New-Haven. She had no cargo on board, except a few salted hides, which were taken out and put on board of a coaster, commanded by Capt. Miles to be transported to New-Haven. This was done without the least injury to any person concerned in removing the hides. At this time happened a long series of easterly winds and rainy weather, succeeding the memorable frost after the 17th of May 1794. In these rains the vessel was washed incessantly day after day, and she was visited by many persons who had business on board; and as it happens with all vessels that lie at a wharf in such a place, hundreds, if not thousands must have been on board, while she lay at New-York. Now it happens that not a soul among all that were on board, from the time of her leaving Martinico, till she arrived at New-Haven, was affected with fever. How the sloop or the hands, after having intercourse with so many persons, came to reserve their infection for New-Haven, I submit to be determined by wiser heads than mine. The facts are here stated from the information of the persons concerned—those which have been before published, are mingled and confounded with popular rumors which can be traced to no genuine sources.

Let it be noted that when the two first persons were seized, no person suspected the disease to be the yellow fever. Mrs.



Gorham probably died without ever knowing her disease—at least her physician did not suspect it, till she vomited black matter, the evening before her death. Hence it happened that no enquiry into the origin of the fever, took place till several days afterwards, and not till after the death of Mr. Austin and his clerk. This is one reason why it became difficult to obtain a true state of facts—a difficulty that was greatly increased by the alarm and consequent perturbation of the public mind.

And after all the question of domestic or foreign origin is much better decided by the character and phenomena of the epidemic, than by any human testimony relating to things not visible. The case of a bilious fever, attended with black vomit, mentioned in page 306 of Vol. I. occurred in the last week in March, near the wharf and in the center of the ground, afterwards the seat of the fever. It was less malignant than in autumn, but from the description of it given me by the woman's mother and the attending clergyman [the physician being dead] I must conclude the disease to have been of the same species, and indicating a disposition in the atmosphere of the place to give to fever that particular character.\* The scarlatina was then the current epidemic. In May this declined, and gradually disappeared, in June and July, as the yellow fever advanced. To a philosophic mind, these facts amount to evidence of domestic origin, that far out-weighs the uncertain and contradictory evidence of the importation of a substance which is neither visible nor tangible.

With respect to the origin of the fever at Hartford, I have this further evidence. The sloop mentioned in page 347, had never been in the least infected with any disease whatever, before she arrived at Hartford. Her former Captain died in May of a lingering complaint. He went to New-York after he was unwell and growing worse, he returned and died at home. Captain Tucker then took the command, went to New-York and took on board a cargo of salt. From thence he sailed to New-Haven, where he lay five or six days, at the wharf, endeavoring to

\* The physician, Dr. Hubbard, after the fever appeared in summer, mentioned to the Rev. Mr. Hubbard, that it was of the same species with that which occurred in March. This case was nine or ten weeks before the arrival of the Iris.

fell the salt. While there, people indiscriminately were onboard, and among them several gentlemen of my acquaintance who give me this information. This was about the middle of July, and as it was just after the Neptune arrived from China, the wharf was unusually crowded with people, who were passing and repassing between the wharf and that ship. Here then the sloop did no mischief. She went to Hartford and discharged her salt. I have unequivocal evidence that not a person concerned in unloading her, was affected with fever, and that several of the persons first seized in Hartford, had not been near her. After she left Hartford the captain and mate were seized, and the former died [not both as stated in page 347.]

Another vessel, I find, has by some been suspected of introducing the fever into Hartford. This also was a coasting vessel, which took in a passenger at New-York, who sickened, after he came on board, and the master landed him at New-Haven. If I am rightly informed, this vessel did not arrive at Hartford, until after the first cases of fever occurred; but of this I am not certain. Certain it is, that no person on board, except the passenger landed at New-Haven, was ever ill, and therefore the case deserves no consideration.

It ought further to be stated that two or three weeks before the alarm at Hartford, and before the arrival of those vessels, a case of fever occurred of the malignant kind, and in all essential points, with the character of the yellow fever. I have lately learnt that a similar fact occurred in Boston in 1798. These cases are not usually numbered with those of yellow fever—but the truth is, and such will it appear to be, when science, philosophy and candor shall triumph over prejudice and popular tales, that these milder cases of fever, bearing the character in a degree, of the subsequent epidemic, are the precursors of the disease to follow—they are the effect of the atmospheric principle on particular susceptible constitutions, before the proper season for the full force of the principle to operate—they are irresistible evidence that the diseases which they precede, are usually, if not always, generated in the place where they exist.

SINCE the first volume was printed, I have obtained from attending physicians, an account of the fever at Middle-Haddam, in the town of Chatham, on Connecticut river in 1796. [This is mentioned in page 331 to have been in 1797, but it was in 1796.]

This fever was traced in every instance to a vessel from a port in Hispaniola, which was highly infected. No person was affected, without direct intercourse with the vessel, the clothing or the sick. About 30 persons were affected, eight of whom died. When carried to a distance, the fever did not spread.

That this was a disease contracted from imported infection is evident from this circumstance—that in every case it could be traced to intercourse with the sick or infected articles—it was not taken by passing along the street nor from house to house. Another fact is equally demonstrative of this origin; which is, that it commenced late in September and had no precursors. When it arises from the atmosphere of the place, it always begins as early as August or earlier—and this is probably true of every autumnal complaint in our latitude.

The fever in that place therefore was what I call a *disease of mere infection*, in contradistinction from yellow fever originating in the country, which begins uniformly in the hot months, is taken without intercourse with the sick or with infected articles, has its precursors and absorbs all other diseases or gives them all its predominant type. The distinction is so obvious that it is not easy to mistake it.

Of the diseases from imported sources, this is one—two or three other instances in the United States have been mentioned. But most of the instances of this fever in America, since 1790, have had the unequivocal characters of epidemics—such characters as never attend, and as cannot possibly attend, diseases of mere infection.

IN the summer past, the wild pigeons in the western parts of New-York state and in Pennsylvania, have been affected with a disease of which many have died. It is understood that the head or neck was swelled; but I have no correct account of the distemper,

FROM the report of a master of a vessel, it appears that fish of various kinds perished in September or October last, on the Carolina coast from Cape Look-out to Cape Fear, a distance of 70 miles. Some were seen dead and others dying, as far as the eye could reach. The yellow fever has also prevailed in some parts of both Carolinas. Does not the death of fish afford reason to believe that the electrical fluid or mephitic air, is occasionally discharged from the earth in unusual abundance? And may not local diseases be ascribed to that cause?

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IN addition to what I have said in the 16th section, relative to predisposition to a particular disease, I would observe, that we ought to make a distinction between a *natural aptitude to a disease*, and an *adventitious liability* to it, from artificial causes. The latter is what usually passes under the name of *predisposition*: And this may lead to error. When persons say, a man will not take a fever by infection unless he is predisposed, they usually mean that he has, by accidental causes, *prepared* his body to be affected. Hence we continually hear the doctrine that infection will not operate in a healthy atmosphere; but in order to give it force and effect, the atmosphere must be *prepared*; that is, must suffer a change favorable to a disease, but not sufficient to produce it.

I apprehend this doctrine is erroneous. The fact, as a general one, is the reverse; and the longer a body remains in health in an infected atmosphere, the less liable is it to the disease. So true is this, that prisoners in jails suffer no injury from the air, which will destroy the lives of men who enter it, from fresh air. This fact is well known. It is equally true, in our cities, during pestilence, that persons from fresh air, are much more liable to be seized, on entering the infected atmosphere, than those who have lived in it. Hence in every case of mere infection, persons are *most exposed* to it, who are *least prepared* or *predisposed* by breathing an infected air.

But not such is the fact with regard to the influence of atmos-



pheric causes on particular bodies. In this case, the cause singles out and seizes the persons, who have a particular aptitude or habit of body, in a manner altogether unaccountable. Sometimes this power is evidently in operation a long time, before it produces disease.

Perhaps the natural aptitude of a body to receive or resist disease, may be illustrated by the following fact, which is under every man's observation. Let two apples or pears, be taken from a tree at the same time—let them be apparently alike in soundness and in every particular on which their preservation may be supposed to depend. Lay them by the side of each other—equally exposed to heat and moisture. In this case, one may and often will perish many weeks before the other. This aptitude to perish is natural, and doubtless consists in the interior organization of the fruit; but this is utterly invisible, even with the best microscope.

This idea seems to be important towards accounting for the operation of a pestilential atmosphere on various bodies, and is confirmed by the facts related of pestilence that has seized particular families or tribes of men, while others, equally exposed, have escaped. This may be called natural predisposition or aptitude to a disease, in distinction from that state of the body which is the effect of artificial or accidental causes, and which may be the commencement of the disease, according to Brown's definition.

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SINCE the first volume was put to press, I have collected from various authors, accounts of several plagues in Egypt, which I had not then found. As I have suggested that pestilence is usually marked by catarrh, it may be proper to lay together further evidence of the fact. Egypt and Constantinople are the places where autumnal fevers are most apt to take the form of pestilence. Catarrh, in those cities, seems closely to attend the plague. Witness the following examples.

A. D.

1580 influenza.

1581 deadly plague in Egypt.

## A. D.

- 1591 influenza.
- 1592 } general plague.
- 1593 }
- 1597 influenza.
- 1598 }
- 1599 } general plague.
- 1600 }
- 1602 influenza.
- 1603 plague.
- 1610 influenza.
- 1611 }
- 1613 } deadly plague in Constantinople, &c.
- 1693 influenza.
- 1694 plague in Egypt.
- 1699 influenza.
- 1700 plague in Egypt.
- 1712 influenza.
- 1713 plague in Egypt.
- 1717 influenza.
- 1717 }
- 1718 } plague in Egypt and Turkey, &c.
- 1726 }
- 1728 } plague in Egypt, &c.
- 1729 influenza.
- 1732 }
- 1733 } plague and influenza.
- 1736 plague deadly in Egypt.
- 1737 influenza.
- 1738 } deadly pestilence in West-Indies, Mexico, Ock-
- 1739 } zakow, &c.
- 1743 influenza and plague.
- 1744 influenza.
- 1745 plague in Egypt.
- 1758 influenza—plague began.
- 1759 plague in Egypt.
- 1762 influenza and plague in the Levant.

- A. D.
- 1767 influenza.
  - 1769 } plague in Constantinople and Egypt.
  - 1770 }
  - 1782 influenza.
  - 1783 }
  - 1784 } plague in Egypt and Asia.
  - 1785 }
  - 1787 plague in Asia and Africa.
  - 1788 influenza in Europe.
  - 1789 influenza in America.
  - 1790 influenza in America.
  - 1791 } began pestilence in America, and West-Indies, which
  - 1792 } has not yet ceased. Severe plague in Egypt.

There are some long periods in which I have no account of the boiling diseases. The plague of 1705 in Egypt is the only one of which I have an account, that I cannot trace to a connection with universal catarrh; and I have no account of a plague in Egypt after the influenza of 1709. I ascribe this however to the imperfection of my accounts. How greatly to be regretted is the want of accurate and complete registers of epidemic diseases!

Let this detail of authentic facts, be compared with what every man may recollect in America. How the present series of plagues was introduced by a double portion of catarrh! for the influenza of 1789 was followed in 1790 by another influenza—the only instance I can find on record of two of these epidemics within the short space of six or eight months! Let it be recollected also that catarrh was prevalent in the spring of 1791, 1793 and 1798, and that in our large cities, pestilence has in every instance, been introduced or followed [or both] by influenza, which has sometimes been local, that is, very much limited to the place where the pestilence had prevailed or was to prevail. Who then can deny that catarrh and plague are connected in cause? It is not possible to deny it—the evidence is conclusive—and when this subject shall be fully investigated, it will appear that pestilence, whether plague or yellow fever, is produced by the same general change in the properties of the air, which produces influenza—the tran-

sitions from the one epidemic to the other being caused by the seasons, or other unknown cause.

I learn from a communication of the British Consul at Alexandria, that it was calculated a million of people had perished by the plague in Upper and Lower Egypt between 1791 and 1796; and our accounts from that country, mention that the disease had not ceased, the last spring; that is, it returned at the proper season. It seems therefore that pestilence in Africa runs contemporaneous with pestilence in America.

I have recently learnt from Irwin's Travels, that there was no plague in Egypt from 1770 to 1777, and from other writers I collect that it was not there for two or three years after. This is a remarkable fact, as Egypt is seldom exempt longer than five years in one period. Now it will be remarked that in the same period, and for some time before and after, no epidemic infectious yellow fever occurred in America, nor as far as I can learn, in the West-India Islands. Yet this was a time of war between Great-Britain, America and France.\* But it is a curious fact, that in those parts of the earth most subject to pestilence, the plague and yellow fever should have disappeared at the same time; and in countries 5000 miles distant, certain kinds of diseases should have lost that peculiar character which distinguishes the plague.

But the history of epidemics furnishes numerous instances of similar revolutions in the prevailing type or character of diseases.

In Mr. Tytler's Treatise on the plague and yellow fever, which I have just read, I find a passage, in page 379, which asserts that certain quotations in my letters to Dr. Currie in 1797 were made "with a view to dispute the contagious nature of the yellow fever." This is not accurate. My view was to prove a material difference in the yellow fever at different times, and to show certain inconsistencies in the reasoning of my antagonist.

\* No comet was seen between 1770 and 1784—a period of more than thirteen years—such an interval had not happened within 150 years, and probably not in three centuries.



It is proper now to mention that I wrote those letters, with a view if possible, to settle the question of the origin of the yellow fever, by a fair statement of facts and fair conclusions from the facts. I had not then attended to the history of epidemics; and it will be seen by one of my letters, that I had embraced the popular opinion then current, that the influenza in 1789 and 1790 was a new disease. Since I have studied this subject, I am surprised not only at my own ignorance, but at the ignorance of all classes of men, in whatever regards the history of epidemic diseases, and the physical phenomena of the earth and atmosphere. On this subject and whatever regards the origin of the plague and yellow fever, Mr. Tytler's Treatise has disappointed my hopes and expectations. His history of pestilence is from first to last imperfect and inaccurate. And how it is possible for a man to suppose that the plague was originally sent upon the Jews as a punishment, and by them has been conveyed to other nations, p. 47. or that the plague in Rome in the year 80 was occasioned by infection conveyed from Jerusalem, by the army of Titus in the year 70. p. 13. 45. 50. Or that it is of divine origin, p. 369, any more than all other distempers—Or that it has been usually propagated by war and commerce p. 369, when it is evident from scripture that it was a disease in Egypt, before the days of Moses—and has in every age infested nations who had no intercourse with the Jews—when also it is expressly declared by Livy and Orosius to have been usually in Rome in time of peace—I say, how it is possible, in this period of the world, for such opinions to exist, I cannot conceive.

On the subject of contagion also, or rather infection, Mr. Tytler, has adopted the common theory—a theory acknowledged to be inadequate to the solution of the phenomena of pestilence; as plague and yellow fever always cease, at the proper season, when the infection is most general.

The results of my investigations will explain most, if not all, the difficulties attending this subject.

The origin of pestilence is traced to essential changes in the atmosphere, which recur at certain unequal periods. The evidence of these changes are certain epidemic diseases, as measles,

affections of the throat, and especially influenza, which pervades the globe or large portions of it within a few months or at most, in two years. Near the time of these phenomena, and usually subsequent to the influenza, the plague occurs in Egypt and Constantinople, and if the change in the atmosphere is very great, the plague occurs in all parts of the Levant and in other parts of Africa, Europe and Asia. At the same time, in the more cool and healthy regions of the north, epidemics of a milder type than the plague, but malignant and infectious, prevail, and in short, ordinary diseases assume new and more fatal symptoms. In America, the same or similar changes are observed. The fever of the West-Indies, which is usually not infectious, becomes more malignant and assumes in a degree the character of the plague. In our large cities, the autumnal remitting fever is changed into the same malignant form, and the country suffers by measles, scarlatina, dysentery, typhus and remitting fevers. These changes usually take place in both hemispheres at the same time; but sometimes the pestilential principle seems to be more severe on one continent or in one country, than in another.

These changes are usually distinguished by visible and remarkable phenomena in the natural world.

The periods of pestilence are unequal and indefinite—sometimes of only five or six years duration; at other times, extending to ten or fifteen years. But in the latter case, the epidemics mentioned usually run through a country twice—that is, two pestilential periods occur, without an interval of time.

During these periods, contagion and infection aid the propagation of certain diseases, particularly the measles, small-pox, whooping cough and angina maligna. In the dysentery, yellow fever and plague, infection has its effect and obviously spreads the diseases. But all those diseases originate without infection, in all countries where the heat, moisture or other local cause will permit the disease to exist. In some cases, they are introduced and spread solely by infection, but they are then always within human control, and it is the fault of man, if the sphere of their operation is not very limited. In most cases, these diseases have the unequivocal characters of local epidemics, and no human power can restrain them.

On the subject of cure, if I may be permitted to have an opinion, I should concur with Mr. Tytler in the preference of the diaphoretic method. Circumstances may indeed defeat this method, and compel the physician to adopt others. But from the indications of nature, and the immense capacity of vapor to absorb heat, I take perspiration to be the natural remedy for fever.

On the subject of the proximate cause of the plague, the opinions of Mr. Tytler are highly respectable. I fully agree with him in the influence of the electrical fluid. I believe this active and elastic principle to be the great agent in all the changes visible and invisible, in our atmosphere, and I cannot but think my investigations have unlocked very important secrets on that point. I believe also that this fluid is the immediate agent in supporting life, and the intellectual powers. Received into the lungs, it supplies the body with heat, and by its elastic power, dilates those organs of life to receive new supplies. The machinery of the body is thus calculated, while it lasts, to preserve perpetual motion. At the same time, this fluid, by the same elastic power, becomes the medium of sensation, throughout the nervous system, and by its instantaneous motions, communicates sensation and thought, with the celerity of lightning.

*New-Haven, November 1799.*



